ENERGY EFFICIENCY IN THE MIDWEST: WHAT IS NEEDED, WHAT IS BEING DONE

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-SEVENTH CONGRESS

SECOND SESSION

JANUARY 22, 1982

[No. 101]

Printed for the use of the
Committee on Science and Technology

U.S. GOVERNMENT PRINTING OFFICE
93-385 O WASHINGTON: 1982

H701-70

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CONTENTS

WITNESSES

	Page
January 22, 1982:	
Dale Moody, director, customer services, Wisconsin Power & Light, Madison, Wis	4
John Kozyrski, director of conservation service, Michigan Consolidated Gas Co., Detroit, Mich	26
Weston D. Birdsall, general manager, Osage Municipal Utilities, Osage, Iowa	52
Robert Burns, vice president, Midland Financial Savings & Loan, Des Moines, Iowa	76
Anthony J. Maggiore, Jr., associate director, Community Relations/Social Development Commission, Milwaukee, Wis	86
Clair Ames, Ames Building Corp., Evansdale, Iowa	103
James E. Woods, Ph. D., P.E., professor, Departments of Mechanical Engineering and Architecture, Iowa State University, Ames, Iowa	126
Eugene Sukup, president, Sukup Manufacturing Co., Sheffield, Iowa	163
Appendix: Additional statements submitted for the record	195

ENERGY EFFICIENCY IN THE MIDWEST: WHAT IS NEEDED, WHAT IS BEING DONE

FRIDAY, JANUARY 22, 1982

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS,
Des Moines, Iowa.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 113, U.S. Federal Building, Hon. Thomas Harkin (vice chairman of the subcommittee) presiding.

Mr. HARKIN. The Subcommittee on Energy Development and Applications of the House Committee on Science and Technology will come to order.

Before I make my opening remarks, I just might say for the benefit of the people who are here who have never attended a congressional hearing before, that this is part of a series of field hearings by the Science and Technology Committee of the House of Representatives, a committee of which I have been a member since 1975. I serve on the Energy Development and Applications Subcommittee as vice chairman.

This is the subcommittee charged with the responsibility for developing legislation and overseeing the development of Federal energy R. & D. programs other than nuclear, which is another subcommittee.

Our subcommittee also has jurisdiction over, for example, the whole area of energy conservation. Mr. Fuqua, who is chairman of the full committee and also chairman of this subcommittee, has had similar hearings, I think, in Florida. The subcommittee will be having other hearings in other parts of the country. But we did want to have this hearing in the Midwest and since I am from the Midwest, I was the logical person to chair the hearing and to find out what the people were doing in the Midwest.

So this is a formal sitting of the subcommittee. Some of my colleagues from Missouri, Minnesota, and Wisconsin, who are on this subcommittee were unable to come today: One, because of weather; and, two, because the House of Representatives is out of session right now. We will be going back into session next Tuesday, and many of their plans just didn't coincide with this hearing.

But it gives me great pleasure to bring the subcommittee to Des Moines and to the Midwest for this hearing on energy efficiency in the Midwest: What is needed and what is being done.

Energy efficiency is a relatively simple concept. It means looking at the task we want our energy systems to perform: Keeping us

warm in winter, cool in summer; providing lighting, refrigeration, mechanical power; supplying process to heat industry; moving us from one place to the other; and determining how to accomplish those tasks, using a minimum amount of nonrenewable energy resources.

It means building a house that uses 20 million Btu's to get through an Iowa winter rather than 60 million Btu's. It means building cars that get 40 miles to a gallon, rather than 20 miles to a gallon. It means taking the waste heat from industrial processes and using it to produce steam and electricity.

All of these energy efficiency improvements have one thing in common. They require the substitution of materials and labor for energy. And those materials and labor are not free. In fact, in today's economy, they are quite costly.

So you can get to the point where the added costs of materials and labor exceed the savings in energy costs for efficiency improvements. Fortunately, that point is easy to calculate. Thanks to research sponsored by the U.S. Department of Energy, we can now determine how much energy would be used in the U.S. economy if we made all our energy investments at the point where new investment in energy efficiency equals the cost of new supply.

The results are extraordinary. Instead of using 100 quads—100 quadrillion Btu's—in the year 2000, as the Department of Energy forecasts, we could get by on 84 quads, according to the Mellon Institute, or as little as 66 quads, if you believe the Solar Energy Research Institute.

By comparison, last year in this Nation we used 78 quads. These reductions would occur without the slightest decline in comfort, lifestyle, mobility, or industrial activity. They will allow us to reduce our imports of foreign oil practically to zero, and to avoid building more than 200 costly and environmentally troublesome new powerplants.

Well, what stops us from realizing this dramatic potential for energy efficiency improvements? The first barrier is capital. The average homeowner simply does not have the $2,000 or $3,000 required to carry out a cost-effective energy efficiency retrofit that would save him up to 40 percent of his fuel bill.

The average homebuilder in the current depressed market is not willing to increase the first cost of the home in order to reduce its energy bills. Businessmen faced with competing demands for scarce investment funds often cannot raise the capital for efficiency improvements, even with 3- or 4-year paybacks. And, of course, the auto industry barely has enough capital to make incremental improvements in the efficiency of its products.

The second problem is information. Most people know that simple efficiency improvements like caulking, weatherstripping, insulation, et cetera, save money. Few know the details about how much can be saved, where one reaches the limit of cost-effectiveness and where one can find reliable products and equipment.

A third barrier has to do with the development of new products. The firms that supply equipment to industry are in many cases either too fragmented or undercapitalized to engage in research, development, and demonstration. Often no one firm can capture the benefits of energy efficiency research.

Finally, there are attitudinal and institutional problems left over from the days of cheap energy that are hard to overcome. Our industrial managers today are often more interested in mergers, acquisitions, and short-term profits than improving the long-term productivity of their plants.

Many of our present-day managers come from the financial world and have little understanding of the technology used or produced by their firms.

Most homeowners and building managers have little experience in making capital investments to reduce operating expenses. We are used to fixing up a basement, adding a new room, redecorating our house, but we are not used to sticking insulation in our attic where we can't see it in order to reduce a fuel bill, especially when that fuel bill goes up anyway due to inflation or a particularly cold winter.

Last night I had a town meeting in Jefferson. An individual came up to me, said that he had taken his home, one that had something like 30 windows in it, cut the number of windows in half, taken off all of his walls, added insulation in all of his walls, insulation in his attic, triple-paned his windows, sealed up every crack in the house—he said if he dropped it in the ocean, it would float—and yet his gas bill is higher now than it was before. That's what I mean. Why do you do those things when your fuel bill is going to go up anyway?

So all that adds up to the fact that the marketplace, acting on its own, will not produce energy efficiency at anywhere near economic levels. Already there is disturbing evidence that a large faction of the energy reductions we have seen to date—perhaps as much as 80 percent—is due to curtailment—using less energy services, rather than efficiency improvement—providing the same services with less energy.

I believe this trend will be exacerbated by the higher energy prices we will see, if the administration gets its way on early natural gas deregulation.

If the President's energy budget for fiscal year 1983 were to be enacted by Congress—which it probably won't—Federal energy efficiency programs would be cut by 98 percent in 3 short years. We would go from $1 billion budget in 1981, to just $20 million in 1983. Major programs to provide retrofit capital to homeowners through the solar and conservation bank and to weatherize low-income homes would be eliminated. Programs to provide information and audits would be wiped out. Programs to develop more efficient appliances, heat pumps, et cetera, to compete with foreign imports would be gone.

Research on energy used in buildings would cease, and all this at a time when our allies in Europe and Japan are increasing their efforts to upgrade their already impressive energy efficiency.

What this will do to U.S. productivity and competitiveness in world markets in the 1980's is quite clear to see. I believe this administration, by its shortsighted energy policy, may be doing more to destroy our industrial competitiveness than all the environmental laws and Government regulations have in the past.

So that's why we are here today. With no support from the Federal Government, we have got to do it on our own. We want to see

what individuals, businesses, and utilities can do on their own to improve energy efficiency; to learn from people in the field what the problems and successful techniques are; to exchange information and new ideas in order to develop an energy policy for the 1980's that is based on experience, rationality, and public interest.

We have three panels. I would like to call each panel to the table for their individual testimony and then we will open it up for questions.

Our first panel will be a utilities panel, and I would like to ask Mr. Dale Moody, director of customer services for Wisconsin Power & Light; Mr. Wes Birdsall, manager of the Osage Municipal Utility; and John Kozyrski, director of conservation service for the Michigan Consolidated Gas Co., Detroit, Mich.

I might also introduce at the table with me are two staff members from the subcommittee. On my left is Dan Steinway, who is our minority counsel; on my right, Dr. Gene Frankel, who is our science consultant. They will have questions.

Perhaps in a little departure from what any of you gentlemen who have testified in Washington have experienced, since our audience isn't all that large and I think we have the time, I would like to open questioning up to the audience after you give your testimony and we have a little bit of exchange. So if any of you hear something that is said and you want to ask a question, grab a pencil and a piece of paper and write it down. And if I call upon you to ask a question and you want to ask a question, will you please get up—for our court reporter—and state your name. If it's not "Smith" or "Doe," would you please spell it out, so we can get it on the record as to who you are.

I have testimony from Mr. Moody, Wisconsin Power & Light, and Mr. Birdsall, and Mr. Kozyrski, so without objection the entire testimony will remain a part of the record.

You may either read your testimony or, if you'd like to paraphrase it and highlight it, that would be fine with me.

In the order that is on the paper, I will call upon Mr. Moody to go first and you can proceed in any manner that you so desire.

Again we welcome you and thank you for coming all the way down today from Wisconsin and Michigan and Osage in this terrible weather to give us the benefit of your knowledge and expertise in what you've been doing. I think we can learn a lot. As I said earlier, I've read over your testimony and I think we will find it very interesting.

So, Mr. Moody, thank you for coming and, again, please proceed.

STATEMENT OF DALE MOODY, DIRECTOR, CUSTOMER SERVICES, WISCONSIN POWER & LIGHT, MADISON, WIS.

Mr. MOODY. Thank you. I appreciate the opportunity to be here.

My name is Dale Moody. I am director of consumer services, Wisconsin Power & Light. Our corporate offices are located in Madison, Wis.

We serve natural gas, electricity in 38 counties, about 600 villages and towns in Wisconsin. We have 35,000 electric customers and 90,000 gas customers.

In the past 4 years, our company has spent approximately $6 million, or the equivalent of about 16 percent of our net income in 1980 on expanded conservation activities related to energy efficiency for both natural gas and electric customers.

We see the rising cost of energy as one of the serious issues facing our industry and our customers. And I would like to briefly review some of the programs that we have underway that we hope will deal with that rising cost of energy issue.

In 1976, the Public Service Commission of Wisconsin approved a trial home energy audit program for our company. Through this program, our goal was to help our customers reduce their space heating consumption by about 25 percent by 1985. To date we have completed over 24,000 audits. This is approximately 27 percent of our space heating customers that we have audited.

We have constructed a series of demonstration homes. We call these retrofit homes. They are existing homes that we have gone into, anywhere from 5 to 50 or 80 years old and weatherized to demonstrate conservation measures. We have done five passive solar demonstration homes for new homes. We have had over 50,000 people tour these homes to primarily demonstrate the most cost-effective measures to weatherize existing homes and we are trying to demonstrate technology on ways new homes can be built.

We've done this in conjunction with local builders and realtors throughout the communities we serve energy in.

We have experimented with modifications to existing heating plants. We thought there were real potentials in modifying—putting a lot of modifications on heating plants. Our test results—we've had several hundred customers on for a couple of years—through our research on that, we have decided not to extensively push that. We have also got service available to our customers. But, we are offering a furnace maintenance program and a safety program which we began last August which 5,000 of our customers have had us come out and tune up their furnace, if you will. And this is a service which the customers are paying for, paying full cost of.

In 1978, we began a project to help our low-income elderly customers reduce their utility costs. We did this in cooperation with the six community action agencies in our service territory. The CAP agencies had abundant amounts of weatherization materials at that time, but lacked enough labor supplied through the CETA program to get it installed. In cooperation with the CAP agencies, we identified a number of the low-income elderly customers and we performed joint energy analysis. We paid for the labor for installing the weatherization materials which CETA supplied and we then did some analyses to find out how effective this was in reducing energy costs for this group of customers.

We have also experimented with solar water heating. In 1979, we began a program of selling and installing domestic solar water heaters. We were attempting to determine the performance characteristics and study solar and utility interface in our load characteristics on our system.

To date, we have sold 140 solar domestic water heaters. And this program is continuing. We have worked with State and local government in assisting in the development of the direct solar rebate

program, the tax assessment aspect and solar rights legislation development.

In 1980, we began a program targeted at rental property weatherization. About 35 percent of our space-heating customers do rent their properties. Therefore, they are faced with a different situation than those people who own their homes. We have formed local advisory committees as well as the State advisory committees. Our committees include both utility representatives rental property owner-managers. We have had 27 committee meetings, at which needs have been assessed. We have audited 350 rental properties as part of this program.

We are also offering what we call a lifestyle audit for renters to show them how, at little or no cost, to reduce their energy costs and increase their energy efficiency. To date, we have completed 760 of these lifestyle audits.

In 1981, Wisconsin Power & Light purchased and installed six wind energy conversion systems, better known as windmills, although they are a little different than the windmills that you may have seen on the farms through history. These six machines were purchased from four different manufacturers and range in size from 10 to 20 kilowatts. The objective of this program: To learn more about wind machine safety, operating characteristics, parallel generation, utility interface, economics, reliability, and be in a position to properly inform our customers on wind energy technology issues. This program will be completed in 1984.

Over the past several years, we have initiated various time-of-use rates for our customers. These rates began with mandatory implementation by large industrial customers. Our company was the first major utility in the Nation to implement such mandatory rates. Currently, time-of-use rates are available for all of our commercial customers and three different residential rates for time-of-use are available.

These rates do provide price-signal, an indirect kind of load control which may be beneficial to the utility. And they provide options for the customers to use energy efficiently and decrease their utility costs. Since the beginning of this rate development, we attribute a shift of about 40,000 kilowatts or 40 megawatts of peak load to the off-peak period. That is one of our goals in our company, to shift loads from the on-peak or high-priced time to the off-peak.

Some other parallel generation programs going where we are aggressively buying back electricity which small power producers produce through small hydro or burning waste, or whatever. We have a number of abandoned hydro sites in the State and there are some people who are doing some renovation of them and we have what we believe is a lucrative buy-back rate for those people to develop those technologies.

During the last several years, Wisconsin Power & Light has greatly increased its energy information and educational efforts through meetings, workshops, and seminars. We have tried to increase our customers' energy awareness. These efforts include a production of 44 different informational brochures, a weekly television show on Public Broadcasting System demonstrating how-to-do conservation methods and numerous free programs done by our speakers bureau.

As Wisconsin is the Nation's Dairy State, we have also organized an agriculturally related services section. This has led to the production of what we call a Guide to Farm Energy Management. We also sponsor an annual farm show which takes place in Madison and attracts over 50,000 people annually.

Through the CACS or the commercial conservation program, although that may lose some Federal funding, right now our company is working in conjunction with our State energy office in developing a prototype program here. And during 1982, we are providing detailed audits to 70 of our small businesses, small industry, and commercial establishments. We think the need is greater there than in the larger ones. We are trying to demonstrate here what a model audit program would be for small customers. We will be determining effectiveness and evaluation of results on this program.

On the broader utility basis, we have been very aggressive in getting off of oil and natural gas generation. About 70 percent of electricity we produce in our company comes from coal; about 25 percent comes from nuclear and the remaining comes from hydro with very, very minimum amounts now attributed to oil and natural gas.

This is a brief overview of our conservation, research, and demonstration activities since 1976. Some of the programs we think have been successful. Some of them we are learning some things and we are probably trying some different things as we continue activities.

At this time, that concludes my prepared statement. Copies of this plus all my exhibits, I hope, will be along soon, and they should be available for anyone who wants to pick them up. Hopefully, they will be here very quickly.

[The prepared statement, plus exhibits[1] of Mr. Moody, follow:]

[1] Due to space limitations not all exhibits referred to in the statement have been reprinted here.

PREPARED STATEMENT OF DALE G. MOODY, DIRECTOR, CONSUMER SERVICES, WISCONSIN POWER AND LIGHT CO.

My name is Dale G. Moody. I am the Director of Consumer Services of Wisconsin Power and Light (WPL) whose corporate offices are located at Madison, Wisconsin.

WPL is a class A Wisconsin utility serving natural gas and electricity in 38 counties encompassing over 600 cities, villages and towns in Wisconsin. We serve 350,000 electric customers and 90,000 gas customers. During the past four years, WPL has spent almost $6,000,000 (the equivalent of 16 percent of WPL net income in 1980) on expanded conservation activities relating to energy efficiency for both natural gas and electric consumers. I would now like to give you a brief synopsis of some of our conservation and energy efficiency activities.

Home Energy Analysis - Exhibit 1 (page 3, number 4) In 1976, the Public Service Commission of Wisconsin approved a trial home energy audit program formulated by WPL. Through this program, we hope to reduce our customers' natural gas consumption by 25 percent by 1985. Since that date, WPL rapidly expanded and promoted the program completing over 24,000 class A audits. This means that to date, WPL has audited almost 27 percent of its natural gas customers. WPL currently uses the Enercom computer audit system to help in reporting and

recordkeeping for the RCS requirements.

Demonstration Homes - Exhibit 1 (page 5, e,f) Exhibit 2, and 3. In 1978, WPL began a research and demonstration program targeted to its natural gas customers. This program culminated in seven retrofit weatherization homes and five passive solar demonstration homes. From these programs, WPL had over 50,000 people tour the homes, seeing demonstrations of the most energy effective and cost effective measures available in these conservation and efficiency strategies. From these demonstrations, WPL was able to determine the most cost effective weatherization and passive strategies for its customers.

Furnace Modifications - Exhibit 4 and 5 During this time, WPL also initiated a furnace modification research program. In this program, four modifications were tested. These modifications included a Derating of the natural gas furnace burner with flue and vent restriction, a furnace vent restriction alone and electric and thermal vent restriction devices. The study included 280 customers as a sample group with modifications rotated in and out weekly. The resultant numbers indicated a savings of from zero to seven percent using the various modifications.

One other result of this program was learning that our customers were in need of furnace service and maintenance on a regular basis. This work was obviously not being performed judging by the condition of many

furnaces in the test program. In order to meet this need and to increase safety, reliability and energy efficiency, WPL offered a "Security Blanket" furnace service and maintenance plan in August, 1981. Since its inception, over 5,000 customers have contracted for this service.

Community Action Program

In 1978, WPL began a project to help its low-income elderly (over 65 years) customers reduce their utility costs. This project was started in conjunction with six Community Action Program (CAP) agencies in our service territory. At that time, the CAP agencies had abundant supplies of weatherization materials, but lacked enough labor (supplied through the CETA) to get it installed. WPL, through the CAP agencies, wanted to identify some of the low-income elderly customers, perform a joint energy analysis, pay for labor for installation of necessary weatherization materials and make a before and after analysis of the homeowners percentage of income to utility cost ratio and the dollar savings attributable to each weatherization measure. We found that identificaion of this customer group was difficult even with the aid of the CAP agencies. This research program was completed in 1980 with 40 homes weatherized to state energy code.

Solar Water Heating - Exhibit 6

In 1979, WPL began a solar domestic water heating sales and installation program. The objectives of this program were to lend credibility to the solar industry in

Wisconsin, determine performance characteristics and study solar and utility interface in load characteristics. To date, WPL has sold 140 solar domestic water heaters. This program in continuing.

WPL also worked with state and local government in assisting with the development of the direct rebate solar program, tax assessment aspects and solar rights development.

Rental Property Program

In 1980, WPL began a continuing program targeted at rental property weatherization. Local advisory committees, as well as a state advisory committee, were formed. These committees included both utility representatives and rental property owners managers. During 27 committee meetings, needs were assessed. WPL then audited 350 rental properties in its service territory at the request of the property owners. WPL also began offering "lifestyle" audits for renters to show them how, for little or no cost, they could reduce their energy costs and increase their energy efficiency. To date, 760 lifestyle audits have been performed.

Wind Energy Program

In late 1981, WPL had purchased and installed six wind energy conversion systems (windmills) in its service territory. These six machines were purchased from four different manufacturers, and range in size from 10 KW to 20 KW. Our objectives in this program are to learn more about wind machine safety, operating characteristics,

parallel generation, utility interface, economics, reliability and be in a position to properly inform our customers on these wind energy technology issues. This program will be completed in 1984.

Time-of-Use Rates - Exhibit 7

Over the past several years, WPL has initiated various time-of-use rates for our customers. These rates began with mandatory implementation by large industrial customers. WPL was the first major utility in the nation to implement such rates. Currently, time-of-use rates are available for all commercial customers and there are three different residential time-of-use rates available. While these rates do provide a price-signal type of indirect load control which may be beneficial to the utility, they also provide options for our customers to use energy efficiently and decrease their utility costs. Since the beginning of this rate development, WPL can attribute a shift of 40 megawatts of peak load to the off-peak period.

Education and Information - Exhibit 1 (pages 1 and 2), Exhibits 8, 9, 10, 11, 12, 13 and 14. During the last several years, WPL has greatly increased its energy information and education efforts. Through meetings, workshops and seminars, we have tried to increase our customers' energy awareness. These efforts included the production of 44 different informational brochures, a weekly television show on PBS demonstrating "how-to" conservation methods and numerious free programs done by

our speakers bureau personnel.

As Wisconsin is the nation's dairy state, we have also organized an agricultural related services section. This lead to the production of a Guide to Farm Energy Management. WPL also sponsors the annual Farm Show, which takes place in Madison and attracts over 50,000 people annually.

Commercial Audits - Exhibit 15

Although the CACS program may lose federal funding, WPL in conjunction with the State of Wisconsin Division of State Energy, felt there is a need for this type of program. During 1982 WPL will begin by providing detailed audits to at least 70 of its "small" (less than 48,000 kilowatt hours and less than 12,000 therms of natural gas annually) commercial customers. Determination of effectiveness and evaluation of results will form the future thrust of this program.

This has been a brief overview of WPL's conservation, research and demonstration activities since 1976. At this time, I would be happy to answer any questions you may have.

93-385 O - 82 - 2

EXHIBIT 1

THE COMPREHENSIVE CONSERVATION PLAN AND REPORT

TO

THE PUBLIC SERVICE COMMISSION

SUBMITTED BY
WISCONSIN POWER AND LIGHT COMPANY
APRIL 1, 1981

1. EDUCATION AND INFORMATION

A. Community Programs and Displays

Wisconsin Power and Light continues to participate in mall shows, county fairs, energy shows, home shows and service club presentations throughout the service territory. There were 255 of these programs held in 1980.

WPL developed a new agricultural display in 1980. The display features a miniature energy efficient farmstead. The Company's other displays are rotated among district offices and are used at public gatherings.

B. Education

In 1980, WP&L offered five Energy Management Workshops through the Cooperative Education Service Agencies (CESA). The workshops were for school district administrators and maintenance personnel. 200 people attended the five workshops. The purpose of the workshops was:

- To provide information on energy issues
- To provide instructional materials
- To inform participants about other available energy related information
- To discuss energy activities that can be used in the classroom

WP&L, upon request, provides energy related booklets to school districts. Among them are: "Our Spaceship-Earth Needs More Fuel," "Energy - Why We Must Conserve it Now," and "Energy Conservation Experiments You Can Do."

An entertaining, educational and informative energy education program for junior and senior high school students was presented to nearly 20,000 students in 1980. The program was given by professionals from Oak Ridge Associated Universities, Oak Ridge, Tenn.

WP&L participates regularly and makes materials available at a variety of State Education Association conferences and seminars.

C. Public Information

1. Gas Conservation Bill Message - In accordance with the PSC Order in Docket No. 1-AC-27, WPL is developing a conservation bill message.

2. Conservation Advertising - WP&L is continuing monthly conservation radio spots. Newspaper ads were also used to introduce the new standards for gas conversions, as specified in 6680-GP-1.

3. Conservation Public Service Messages - WP&L produced television public service announcements on energy conservation that were aired on the State Public Television Network. The announcements addressed the following topics: infiltration, caulking, weatherstripping, insulation, venting, fireplaces, glass doors and fresh air intake. The appropriate WP&L brochures relating to the topic discussed were shown. Customers were invited to call or write to WP&L for copies of the brochures. Tom Smith, of the University of Wisconsin Energy Extension Service, served as narrator.

4. Brochures - WP&L has 27 brochures available to customers. One new brochure is on the new standards for gas conversion (6680-GP-1). WP&L is also planning a revised brochure for renters and a brochure on safety considerations in weatherization work.

5. Phone Service - The free telephone service described in the Fourth Conservation Report to the PSC, April 1, 1979, is still in operation at this time.

2. LOAN FINANCING AND RATES

A. State-Wide Programs

There are loans available for energy conservation from the Department of Energy, Farm Home Administration, HUD, and from County Veterans Offices. Most of these loans are for low-income families or, in the case of the County Veterans Office, for veterans. Loans for rental property are virtually at going market rates although both Farm Home Administration and HUD are looking at low interest loans for rental properties. WP&L is continuing to monitor all available programs for customer energy assistance.

3. CONSERVATION STANDARDS

WP&L is enforcing the Order in Docket No. 6680-GP-1 for gas conversion standards. A newspaper ad and customer brochure have been developed that explain the standards.

4. INDIVIDUAL COUNSELING

A. Audit and Inspection Program

Through December 31, 1980, 20,743 audits have been completed (19,021 on owner occupied, 1,722 on rental property). The following is a list of items covered in the audit:

- Caulking
- Weatherstripping windows
- Storm windows
- Storm doors
- Insulation for attic, sill box, water heaters and exposed pipes
- Water flow restrictors
- Lower thermostat
- Install night setback thermostat
- Lower hot water temperature
- Change or clean furnace filters
- Electric ignition on furnace
- Fresh air intake to furnace
- Automatic vent dampers for furnace
- Clean and check air conditioning filter
- Room air conditioners at the end of the season (remove or cover and weatherstrip)
- Crawl spaces (add ventilation, moisture barrier, heating ducts and water pipes wrapped, insulate ceilings and/or walls)
- Clear obstructions from attic vents
- High venting
- Low venting
- Repair roof leaks
- Check for insulation covered recessed lights and potential hazards

The following are ways audits are encouraged:

- Direct mail
- Sign-up sheets featured at other Company demonstration projects, including Passive Solar Homes and Energy Saver (Retrofit) Homes.
- Sign-up sheets at fairs, mall shows, etc.
- Newspaper ads
- Radio ads

- School and community programs
- Posters
- Customers with new homes, receiving a gas permit are encouraged to have an audit

B. Auditor Training

All WP&L auditors have completed the five-day UW Extension Audit Course. A refresher course on auditing are also given by Company personnel as required. All auditors receive personal on-the-job training as they are required to periodically accompany experienced auditors on actual home audits.

All auditors are presently enrolled in a five-day Company offered course, "Consumer Services Communications Program." This course is designed to give auditors the necessary communication skills to encourage customers to conserve energy. Also additional training sessions were held on heating systems, steady-state efficiencies, and alternative energy.

C. Insulation Contractors Registration Program

The list of registered contractors who meet standards established by WP&L is still made available to customers. The list is updated quarterly. There are 70 contractors on the list as of the last quarter of 1980. This listing process will be discontinued when the RCS program becomes operational.

D. Audit Evaluation

The residential gas audit program was evaluated in September, 1980. It was found that two-thirds of all audited homes follow through on at least one weatherization suggestion. The most likely measure to be instituted is caulking of the outer shell where dissimilar materials meet.

Estimates of savings attributible to the audit program range from 1-3%. The small level of average savings indicates that audited customers are not any more likely to adopt weatherization measures than non-audited customers. (See attached copy for further information).

5. SPECIAL PROJECTS

A. Furnace Modifications

This program as described in The Comprehensive Conservation Plan and Report to the PSC, September 28, 1979, is being implemented. A preliminary report may be ready in the spring of 1981.

B. Dew Point Effects

The research, as outlined in The Comprehensive Conservation Plan and Report to the PSC, September 28, 1979, is ongoing.

C. Pulse Combustion Boiler Test

The project as described in The Comprehensive Conservation Plan and Report to the PSC, September 28, 1979, was completed in June, 1980. Under controlled test conditions, a seasonal efficiency approximating 90% was realized.

D. Hybrid Heat Pumps

After performing a life cycle cost analysis and economic justification for a hybrid heat pump, WP&L has instituted a study to verify some of the assumptions made for the analysis. WP&L is monitoring 18 hybrid systems installed by electric customers. The systems chosen have propane, oil, and natural gas for backup fuels.

E. Energy Saver (Retrofit) Home Demonstration Program

WP&L will be continuing the Energy Saver Home Demonstration Program in the future.

F. Passive Solar Home Project

The Company planned two homes for 1980. One home was in the East Side Parade of Homes. It utilizes an isolated or direct gain system. WP&L's second passive home in 1980 was in Mauston and utilizes a partial Trombe wall. Passive solar homes in Janesville, Beloit and Fond du Lac, now closed to the public, will be monitored for 2-4 years.

G. Solar Grain Drying

WP&L has a new computer program that will calculate a customer's energy costs for their grain drying system. Use of the program was made available at the recent Electric Power and Farm Equipment Show.

H. Gas Light Program

WP&L conducted a test program to disconnect customer's natural gas lights. The Company made program modifications when the test program results were available. Implementation on a Company-wide basis occurred in late spring, 1980. Approximately 94% of the gas lights identified in WP&L's gas service territory have been disconnected. Completion of the disconnection program will not be accomplished until 1981 because either the ground is frozen or the customer's application for exemption to the order is pending.

I. Commercial and Industrial Program

WP&L is currently undertaking an extensive planning process for the Company's Commercial/Industrial Energy Conservation Program. This involves gathering data on the needs of this Sector and determining methods of meeting those requirements not presently being met. A major part of this activity will be the development of a small commercial energy audit program. A joint WP&L and Division of State Energy project is being explored to develop an audit and audit training course. The program is now seeking funding from DOSE.

J. Groundwater Heat Pumps

Three groundwater heat pumps, purchased by WP&L, will be resold to interested customers at cost and monitored for two heating seasons. One was connected in 1980 in Token Creek, Wisconsin. WP&L will determine operating efficiencies and costs of groundwater heat pumps.

K. Wind Machines

WP&L purchased six wind machines from four manufacturers. Two were installed during November and December, 1980. WP&L is also metering four existing windmills. All of these will be monitored for a period of two years during which WP&L will collect data on power production, wind speeds, maintenance, hours of operation, television interference, etc.

L. Time-of-Day Water Heating (RW-5)

Rw-5 was developed to provide electric water heating customers an opportunity to utilize time-of-day rates and to provide WP&L with a known quantity of load shift to the off peak. The first 8 customers were signed up by the end of 1980.

M. Low-Income Elderly Energy Research Program

This program is being done in conjunction with local Community Action Programs (CAP) agencies. WP&L will assist CAP in weatherizing up to 100 homes throughout the service territory. WP&L will pay for the contract labor to insulate and vent and CAP will furnish the materials. The existing program is being evaluated as to future program direction.

6. RENTAL PROPERTY

WP&L is reinstating and expanding the voluntary rental property program to additional communities. An implementation plan is being prepared.

The Company has collected data on single family owner-occupied and single family rental properties, multi-family master metered, and multi-family individually metered rental properties. Comparisons have been made to determine the present weatherization conditions of each and to compare owner-occupied versus rental properties.

A concentrated effort is being made to identify the rental properties in WP&L's natural gas territory. The Company is also trying to identify the owners of the rental properties and to categorize them by number of units and whether they are individually or master metered.

EXHIBIT 3

A UTILITY'S INVOLVEMENT IN PROMOTING AND CONSTRUCTING PASSIVE SOLAR HOMES

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USA

ABSTRACT

This paper will deal with Wisconsin Power and Light Company's involvement in energy efficient construction, specifically, passive solar space heating.

Wisconsin Power and Light has one of the most innovative and active energy conservation plans in Wisconsin. The Company realizes that through reasonable growth and increased energy efficiency it can remain financially and socially strong. Our passive solar program was developed to promote energy efficient design, construction, and marketing techniques. Our position is, that to accomplish the goal of customer energy awareness and have energy efficient homes become a more commonplace item, both the construction and architectural industries must be stimulated. WP&L has been willing to underwrite the risk which is necessary to encourage the stimulation and innovation.

WP&L subsidized construction of three passive solar homes in 1978 and 1979 and will subsidize two more in 1980. Each home incorporates different passive solar design concepts. The homes are fully monitored and will remain so for up to four years. One of the homes won both design and construction awards from HUD.

This paper will deal with the effectiveness of our overall program and its results on increasing the feasibility of passive solar construction and the viability of the passive solar market.

1. HISTORY

The Public Service Commission of the State of Wisconsin authorized the collection of funds from natural gas utility customers in 1977. These funds were collected by utilities from all their natural gas customers. The funds were to be used for energy conservation programs which would help to increase the customers' energy awareness and energy-efficiency, as well as reduce the consumption of natural gas. One part of Wisconsin Power & Light Company's (WP&L) conservation program, the passive solar demonstration home construction project, will be detailed in this paper.

2. THE COMPANY

WP&L is a utility serving over 300,000 electgic customers and 89,000 natural gas customers. The service territory is spread over an area equivalent to 1/3 of the State.

One of the goals of the Company was to reduce total customer natural gas consumption by 25% by 1985, while, at the same time, promoting reasonable customer growth. This was to be achieved through programs geared to increase customer energy-efficiency by promoting the idea of "doing more with less", and showing our customers how this could be accomplished.

3. THE PROJECT

After consideration of both passive and active solar space heating systems, it was decided that passive solar demonstration homes was one way in which we could begin to accomplish the above goals. When the project was implemented, there were no tax incentives for active solar, and an investment in active systems did not show as favorable a rate-of-return as did an investment in passive strategies.

In order to maximize visitation and to increase customer awareness of

passive solar space heating concepts, WP&L located the homes in the most populous areas of its service territory. Janesville, Beloit (both in Southern Wisconsin), and Fond du Lac (East Central Wisconsin) were chosen as sites. All three areas are in the 7,000 - 8,000 heating degree day range. The 1980 homes located in Madison (South Central Wisconsin) and Mauston (West Central Wisconsin) are also in this heating degree-day range.

While it was important to increase the awareness of "local" architects to passive solar, there were none in the Southern portion of the state who we felt were familiar enough with the concepts or had enough practical experience to work on this project. Therefore, James Cardwell Architect & Assoc. of Portsmouth, New Hampshire was contracted to design the Beloit and Janesville homes. The Fond du Lac and Mauston homes were designed by Graven & Associates of Madison, Wisconsin. The Madison home was designed and built by Northland Country Homes of Middleton, Wisconsin.

4. THE HOMES

4.1 Beloit

This home was a three bedroom ranch design with 1729 ft.^{2} of finished living area and a 1605 ft.^{2} unfinished basement. The home contained 174 ft.^{2} of south facing double-glazed windows and only 50 ft.^{2} of north facing triple-glazed windows. The home used a direct gain concept with a thermal mass consisting of concrete floor planking (Flexicore) with a 2 inch poured concrete "cap". The floor finish was slate tiles. Insulated wooden bi-fold doors were used for night insulation. The passive solar concepts along with other weatherization strategies helped reduce, by about 50%, the home heating requirements of 61.2 x 10^6 BTU/yr.

4.2 Janesville

This was a two-story Tudor design with 1800 ft.^{2} of finished living space and a 1000 ft.^{2} unfinished basement. There were 156 ft.^{2} of south facing double-glazed windows and 16.5 ft.^{2} of triple-glazed north facing windows. In addition to direct gain, an isolated "storage" system was used. This consisted of a rock bin in the basement of the home which received no direct solar radiation, only excess heat from the living areas. While no significant heat is returned from the rock storage, the bin does provide an excellent heat sink, and helps to reduce temperature swings. Again, insulated wooden bi-fold doors were used for night insulation. Passive solar design along with the related energy reducing features supplied about 45% of the total net heating load of 61.0 x 10^6 BTU/yr.

4.3 Fond du Lac

This split-foyer home included 2088 ft.^{2} of finished living space. There were 165 ft.^{2} of south facing double-glazed windows. The thermal mass consisted of a mass wall 40 feet long, 4 feet high and 12 inches thick. The wall was covered with triple-glazed Kal-Wal panels to form a "dead" air-space on the outside of the mass wall. Insulated "Roman shades" were used for night insulation. This concept delivered about 50% of the net heating load of 58.5 x 10^6 BTU/yr.

4.4 Madison

Recently finished, this tri-level home contains 1600 ft.^{2} of finished living space. There were 271 ft.^{2} of floor area in an attached greenhouse. The home used direct gain principles in the upper levels with conventional floor trusses covered with a 2-inch concrete cap and a finish of quarry stone for thermal mass. A double application of dry wall was used in the kitchen area to further reduce the possibility of overheating. Ths position of the greenhouse allowed part of the 8-inch thick concrete foundation to be used as a mass wall to enhance the isolated gain. Roman shades were used for night nsulation. WP&L also markets active solar domestic hot water heating systems, and one was installed on this house.

The pasive design yields up to 50% of the home's net heating load of 72.0 x 10^6 BTU/yr.

4.5 Mauston

Currently under construction, this split-foyer home is similar in concept to the Fond du Lac home. It will contain 1300 ft.^{2} of finished living space in the upper level and 1300 ft.^{2} of combination basement/living area downstairs.

Direct gain is utilized on both levels with a 196 ft.^{2} mass wall which serves as the thermal mass. Kal-Wal triple-glazed panels are used to form the "dead" air-space on the outside of the wall. One distinct difference between this home and the Fond du Lac home is that the Mauston home uses 207 ft.^{2} of triple-glazed south facing windows and no night insulation. The passive design should yield about 40% of the total net heating load of 68.0 x 10^6 BTU/yr. This home will also be fitted with a WP&L solar domestic hot water heating system.

5. THE PROJECT

All the builders were unfamiliar with passive solar concepts but adapted with very few problems. The houses were constructed on a speculative basis with WP&L paying for design costs and all costs directly related to passive solar elements of the homes.

When completed, the homes were shown to the public by WP&L for a period of 90-days. It was also stipulated that WP&L would monitor the homes for up to four years. A consultant, Michael Utzinger, was hired by WP&L to help develop monitoring systems and advise on other related areas. He also coordinated computer simulations, the TRNSYS program with the University of Wisconsin Solar Energy Laboratory.

6. THE DEMONSTRATION

When completed, the homes were staffed by WP&L employees and tours were given to the general public. About $10,000.00 per home was spent on media development to increase visibility and attendance. The homes were open one weeknight and weekend afternoons for a 90-day period. There were "special-interest" group tours in addition to the "Open House" concept.

WP&L also has an annual event known as the "Builder/Banker Seminar." This seminar includes builders and bankers from throughout our service territory. The Seminar group toured the Janesville and Beloit homes and were informed about the basics of passive solar systems as well as the necessity for acceptance of these concepts in the lending and construction industries.

In total, over 10,000 people toured the three homes. The Mauston and Madison homes will not be open until after this paper is completed.

7. THE RESULTS

People were shown various passive strategies and were also made aware of the passive solar concept. Builders in all three areas who had never heard of passive solar are now marketing various energy-efficient homes (including factory-built homes) incorporating aspects of passive solar-design. There have been hundreds of inquiries about the project from our customers, builders, and architects. This was due in great part to receiving both design and construction awards from HUD for the Beloit home. The project even precipitated two inquiries from England.

Through this project, WP&L has learned more about marketing the passive concept, effectiveness of various techniques, how lending institutions view this concept, and the impacts of these types of homes on our natural gas and electric system loads.

We feel this concept, especially in new construction, is not only cost-effective but also "energy-effective" and should be considered whenever possible in new construction.

Monitoring data is preliminary at this point. However, by the end of the 1980-81 heating season, we will have well-documented information as to the actual thermal effectiveness of each home.

8. CONCLUSION

WP&L considers this project a success. Not only have our customers been enlightened about passive solar but WP&L has also learned a great deal from the overall project.

As we continue to strive towards our goal of increased energy- efficiency, the hope is that passive solar space heating will substantially increase in the marketplace. WP&L through this project, and many others, will continue to promote energy-efficiency and ways to "do more with less." By increasing customer energy-efficiency, a utility is able to defer, for a time, the expense of generating station construction.

While these facilities will increase along with responsible residential, commercial, and industrial growth, the time gained through use of renewable resource technology benefits both the utility and its customers. This extra time before the utility must incur such expenses can be directly related to a longer period between rate increases.

As long as the incentives remain for both the utility and its customers, WP&L will continue to encourage energy-efficiency and will help to underwrite the cost of innovation.

SS:dr
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Mr. HARKIN. That is my office, I believe, that has those copies. If they don't arrive here, you can get them through my office. I have a staff person, I think, who is on the highway right now trying to get those here.

If she doesn't make it, you can get them later from my office.

Thank you very much, Mr. Moody, and rather than opening up for questions now, I would like to go ahead and finish the panel.

One change. I would like to call on Mr. Kozyrski. I thought, maybe, we'd do the biggies first and then get to the municipal utility at the end. We will keep you two together and see what the municipal utility has to say at the end.

So, if you don't mind, Mr. Kozyrski, again, please proceed, and a copy of your testimony will be made a part of the record in its entirety. You proceed as you so desire.

STATEMENT OF JOHN KOZYRSKI, DIRECTOR OF CONSERVATION SERVICE, MICHIGAN CONSOLIDATED GAS CO., DETROIT, MICH.

Mr. KOZYRSKI. Thank you very much.

My name is John Kozyrski. I am director of energy conservation services for Michigan Consolidated Gas Co. We are located in Detroit.

We are a natural gas distribution company and we provide natural gas service to approximately 1 million residential customers in Michigan. Our primary gas service area is in southeastern Michigan in the Detroit area. We supply the western portion of Michigan at Grand Rapids and Muskegon. We also provide most of the geographic area in northern Michigan and the Upper Peninsula.

I want to thank the subcommittee and the chairman for inviting us to attend this morning and discuss energy conservation because at Michigan Consolidated we have felt that energy conservation had been an important issue for a long period of time.

Mr. HARKIN. Excuse me, Mr. Kozyrski, if I could just interrupt you for one second, where do you buy your gas?

Mr. KOZYRSKI. We buy gas from numerous sources, primarily on the interstate market, from Michigan-Wisconsin pipeline, Panhandle Eastern, and we buy gas from Great Lakes Transmission, which is Canadian. Fifteen percent of our supply comes from sources within the State of Michigan.

Mr. HARKIN. OK, thank you.

Mr. KOZYRSKI. My purpose, today, is to review with you the activity of Michigan Consolidated in its efforts to assist its customers during the current period of rising natural gas prices.

If I can, I would just like to digress for a moment and go back to 1973, at the time of the oil embargo. We saw a transition period take place there and it took place rather rapidly. We saw many residential customers look for less expensive heating fuel. They switched from oil to natural gas. We saw a tremendous change in our automobiles. There was a significant demand placed upon the automobile industry for smaller, lighter, more efficient automobiles.

We think a similar transition is going to take place very soon as a result of the Natural Gas Policy Act, which presently has phased

the deregulation of natural gas and will deregulate natural gas as indicated in the act in January 1985.

We think it could be a traumatic transition period, particularly in the Midwest where most homes are heated with natural gas. Heating costs will be increasing at an approximate annual rate of 20 to 25 percent.

Obviously, demands will be made by consumers for lower fuel prices. And in the alternative, consumers will also be looking for methods to control their natural gas energy costs.

We have the opportunity to actively provide consumers with energy knowledge and assistance to order this transitional period of rising natural gas prices. Michigan Consolidated Gas Co. has actively pursued energy conservation since the early 1970's, and now has several conservation programs to aid its customers.

What I'd like to do is just recap where we've been in the early 1970's. Around 1973, we implemented a ceiling insulation program, which became a model program for other insulation programs throughout the United States.

Primarily, what it was was an assistance program providing instructional booklets to customers for the installation of ceiling insulation. We provided financing at a rate of 12 percent for all customers. And at this point, we consider the project an unqualified success.

Subsequent to that program, we also instituted, through advertisements, a dial-down program. We found that through each degree that a customer dials down their thermostat over a 24-hour period, the customer could save approximately 3 percent of his natural gas consumption. That program was also successful.

Today what we have are three additional programs and what I would like to do is briefly run through those programs. I do have a prepared statement and I have entered in the statement quite a few of the specifics of the program. What I would like to do is just briefly review what these programs consist of.

The first one is a residential conservation services program. I would like to take credit and say that it is a Michigan Consolidated program, but we are implementing this program under the Michigan Residential Conservation Services program, which was submitted to the Department of Energy, under the mandate requirement of the National Energy Conservation Policy Act of 1978.

This program provides custom home energy analyses of the heating requirements of the customers' homes. It reviews approximately 30 opportunities for the customer to conserve energy. It looks at insulation, weatherstripping, clock thermostats, caulking, storm windows, storm doors, water heating insulation, furnace retrofit devices, heating and air conditioning replacements.

What it does for the customer, it gives him an indication of what the installation costs would be to implement these conservation techniques. It provides costs for not only contractor-installed installations, it also provides the cost if the customers are going to install the energy conservation measure themselves.

It indicates what the cost effectiveness of each conservation installation is going to be, and that measure is in the form of a simple year's payback. It provides an example of what the payback

would be for all conservation measures, whether they be installed by contractors or by the customer.

It provides low-cost, no-cost energy practices that we have found very helpful for customers. It provides do-it-yourself manuals. We have provided a separate manual which describes in detail how customers can proceed with those conservation measures which can be self-installed.

It provides a listing of contractors if the customer chooses to have installations made by contractors. It provides a local list of who these contractors are, where they are, and the type of work they perform.

It also provides assistance to the customer in filling out bidding applications or bids in order to seek contractor services. It provides lender listings of financial institutions that provide assistance for the customers in order to make some of these conservation installations.

The auditors that perform the service also provide the consumer with assistance in filling out credit applications.

And last, if any customers are apprehensive about doing their own installation or are apprehensive about having the contractors do the installations, we provide inspections of the final work. Those are on customer request and also there are some mandatory inspections required under the program.

To date, we have had a response rate of approximately 60,000 customers. That is an average response rate of about 6 percent of our total 1 million residential customers. We began implementing the program in July 1981. We have been in operation for about 6 months. We think the response has been exceptional.

And by the way, the electric utilities are also providing a similar service. And in our service area, the complementary electric utilities are providing audits with similar results. Together, we are aware that the level of participation significantly exceeds the overall 6 percent for our alone. In some communities, the response rate just for participation in our program has been as high as 11 percent.

Michigan, as a total, is now approaching approximately 200,000 requests for the conservation service. While we believe the RCS program is definitely valuable to the customer, we also look to the future of the RCS program. Particularly in the Michigan Residential Conservation Services program, the customer is provided the opportunity to request an audit every 2 years. And while on the front end there is a significant cost to provide this service, most of that service is embedded in the time required of the auditor to evaluate the customer's home, its construction and take measurements in order to do the custom analysis of what the heating requirements are.

Subsequent inspections will not require that that work be done and we can devote our attention to more significant items, some of the more expensive items. And during the next several years, we are going to see energy costs and natural gas costs increase at rates between 20 and 25 percent. We believe that many replacements like replacements of heating systems and replacements of water heaters will become cost-effective installations.

Many of the state-of-the-art equipment now have significantly increased efficiency and we think that, together with even some solar systems, will be installed in many of the customers' homes within our service area.

Since about the midseventies, we have taken a look at the average consumption of our residential customers. We have seen a decrease from a level of about 195,000 cubic feet of gas, to a level of about 162. That's over a 6-year period of decline of about 17 percent. Obviously, that's a substantial decline.

However, when we take a look at the opportunities in each one of the customer's homes, we see that the majority of the potential for conservation still exists within the residential customer's home. We think we can get customer's consumption down in the range of 120 to 130, so there is still a significant amount of work that has to be done.

Our second conservation program and it complements the first very well, is called our interest-free program. Simply what this does, it provides loans to customers for two conservation measures that we think are the most cost effective. The first is ceiling insulation. We provide loans for contractor-installed insulation, as well as do-it-yourself installation. The contractor loans are available up to limits of $1,000; do-it-yourself loans are available up to $750.

We also provide loans for furnace retrofit devices. These are flue dampers as well as flue restrictors. These loans are available up to limits of $500. Combinations of insulation and furnace retrofit devices can approach $1,250 and $1,500. We extend payments of up to 5 years or 60 months.

This program has had a rather lengthy genesis. It really started back in 1975. After we implemented our ceiling insulation program, we took a look at the other things that we could do in the customer's home to help him conserve energy. We embarked on a test program to evaluate five energy conservation techniques that could be applied to a customer's heating system. We identified that we could install flue dampers to keep the warm air inside the customer's home when the furnace is in the off condition. We found that chimneys within our service area, particularly, are grossly oversized. We found that there was considerably greater draft in customer's homes than was required.

We began testing of a flue restrictor which is just a fixed plate within the customer's flue to reduce the potential draft across the chimney. The restructor will custom size the chimney potential draft with the requirements of the furnace.

We also took a look at two-stage regulators to reduce the furnace input in fringe months as compared to the peak heating season. We looked at derating the customer's furnace because we found that in all instances furnaces were at least 20 percent oversized and in many instances they were up to 50 percent oversized. And last, we looked at the opportunity to replace a gas pilot with an electric pilot.

The test programs began in 1975. In 1977, we had our results and we submitted an application to Michigan Public Service Commission to implement a program.

The hearings of the program were interrupted for approximately 18 months to do additional testing. But in May of 1981, we received

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an order for this program and we began implementation and began providing interest-free loans to our customers.

We found that our estimates for the conservation that we could derive from the program demonstrated clearly that this was a cost-effective program, not only for the participating customers but also for the nonparticipating customers.

Mr. HARKIN. Excuse me. Are you saying you provide interest-free loans?

Mr. KOZYRSKI. Interest-free loans.

Mr. HARKIN. Not 5 percent?

Mr. KOZYRSKI. Not 5 percent.

Mr. HARKIN. Not 10 percent?

Mr. KOZYRSKI. Zero.

Mr. HARKIN. Zero.

Mr. KOZYRSKI. Zero.

Mr. HARKIN. OK, we will get into that later.

Mr. KOZYRSKI. We have found that our estimates of the energy savings that could be derived from the conservation for people participating in this program provided us with an additional supply of natural gas for a lesser price, approaching several times less than purchasing incremental supplies of natural gas from pipelines.

We received approval for this program in May 1981. We began a marked advertising campaign about September. We have been operating the program for approximately 3 to 4 months right now and we have had approximately 13,000 inquiries.

Our target for the first year is approximately 20,000 loans.

Our last program is called Insulation Outreach. This is a rather unique program which should generate some questions. If you looked at the RCS program you found that it is primarily an educational tool that provides customers with an education in conservation. It provides them direction on how to participate in energy conservation. Although the timing of our interest-free program was not planned as it did take place, the interest-free program does augment the RCS program rather conveniently because it does provide the customer who wants to participate in energy conservation, whether that be insulation or furnace retrofit devices, by providing them with the opportunity to take loans through the gas company at no interest over a 5-year period.

While those two programs complement each other very well, we have found a void for some of our customers. We found that many of the low-income customers, while they receive the educational assistance, while they receive the direction on how to conserve energy, still did not have adequate income even to take out the principal on the interest-free loans. So what we developed was insulation outreach.

What this program does, it provides to low-income customers an RCS analysis at no charge and in addition, if the customer qualifies, we will also provide ceiling insulation in the customer's home at no charge. That will be done by contractor, and if the customer chooses and if their ceiling qualifies, we will also let them do the insulation themselves. We will arrange for the insulation to be delivered to the customer's home. If he does this, we will additionally provide him with a $50 incentive fee.

The benefits from the program are very similar to the others that we derive from the RCS program and our interest-free program. First of all, what it does, it extends our existing natural gas resources. Obviously, the least expensive natural gas supplies that we have at this time are those that we already have under contract. It extends those over further periods. It delays the time period in which we have to seek supplemental natural gas supply sources or synthetic gas, imported gas.

And particularly within our service area—we supply metropolitan Detroit—we have a significant bad-debt expense problem; substantial uncollectables. What this program does, it targets low-income customers and it helps us specifically to reduce uncollectables which are paid by all customers of the company. It helps us reduce those bad-debt expenses.

This program is presently being proposed to the Michigan Public Service Commission. It is being proposed in a joint application with the three largest utilities in the State which are Michigan Consolidated, together with Detroit Edison and Consumers Power.

This program was proposed in May 1981, and we are presently operating under Commission order to temporarily defer the costs of the program. We will expend—each utility will expend up to $2 million on the program, or until the 1 year expires.

We have completed hearings for the program and we expect an order in approximately mid-1982. If we do get an approval for the program, we will continue for an additional 2-year period. What the approval of the program will do is that it will permit us to implement a surcharge which will recover the cost of the program. If the program is not approved, the $2 million that we spend on the front end of the program will simply be an investment in our low-income customers.

We think that we can derive similar benefits from this program that we derive from other conservation programs and we look forward to significant conservation opportunities within these low-income homes.

As a public utility, Michigan Consolidated has an obligation to furnish gas service in areas where it is franchised. Needless to say, the chief element to furnish adequate gas is gas supply. The conservation programs I have discussed certainly provide gas volume to supplement our existing supply and serve new customers. However, conservation is clearly not the whole answer to our supply needs.

If there is no underlying gas supply, there is nothing to conserve. Conservation needs to be added to effective efforts to maintain adequate natural gas supply. Michigan Consolidated, like other utilities in Michigan, depends primarily on interstate gas pipelines for its supply. We earnestly look to the Federal Government to take appropriate action to maintain natural gas production in the United States to meet the needs of all residential, commercial, and industrial customers now and in the future.

Additionally, Federal support is needed to preserve the gas volumes conserved by the types of programs I have discussed. Under existing statute there is a risk that conservation may reduce utility gas supply. Notwithstanding current levels of gas supply, which are adequate to meet consumer demand, natural gas continues to be consumed in greater volumes than it is produced.

In time, without a change in this relationship, we will again confront curtailments of gas supply similar to what we experienced in 1976.

Current pipeline curtailments are based upon customer end use. Somewhat oversimplified, end use is considered from highest priority to lowest priority or residential, agricultural, commercial, industrial, processing feedstock and other remaining requirements.

The pipeline's limited gas supply is shared among its customers in accordance with these end uses. Distribution companies with proportionately more high end-use sales and proportionately less low end-use sales receive proportionately more gas. By definition, successful conservation programs would reduce the volume of gas a utility sells to its highest priority customers. Conservation programs might also enable utilities to avoid or defer curtailment of low end uses. It could therefore place conservation conscious utilities in a worse position than other utilities that have not conserved gas, both in pipeline curtailments and in the potential allocation of new gas supplies.

To date, gas distribution companies have not been penalized for conservation measures because pipeline curtailment plans have been based upon earlier fixed base periods.

Unless a utility which supports conservation measures can retain the gas supply conserved, conservation may not be such a good idea. There is no benefit to a utility from conservation if it loses gas from other sources and there is no benefit, or at least a greatly diminished benefit to the utility customer who conserves, because the loss of supply to a utility will reduce its potential sales and increase the customer's rates if fixed costs are spread over fewer gas volumes.

Again, we look to Congress to insure that the utility which conserves gas may continue to retain that gas for the future benefit of its customers.

I think at this time I want to thank the chairman of the committee for the opportunity to be here today and I want to assure the committee that Michigan Consolidated will continue its efforts in conservation to conserve gas supplies and assist its customers to control their energy costs.

[Mr. Kozyrski's prepared statement follows:]

PREPARED STATEMENT OF JOHN J. KOZYRSKI, DIRECTOR, CONSERVATION SERVICES, MICHIGAN CONSOLIDATED GAS CO.

Mr. Chairman and Members of the Subcommittee: My name is John J. Kozyrski, and I am Director of Conservation Services of Michigan Consolidated Gas Company, a wholly-owned subsidiary of Primark Corporation, with headquarters in Detroit, Michigan. Michigan Consolidated is a gas distribution company serving over one million customers in the metropolitan areas of Detroit, Ann Arbor, Grand Rapids, Muskegon and the Northern portion of Michigan's lower peninsula and portions of the upper peninsula.

I thank the Subcommittee, Mr. Chairman, for the invitation to appear here today and discuss the activity and programs being carried out to improve energy efficiency in the Midwest. I am sure that the vital national interest in conserving gas, along with other forms of energy, requires no demonstration. In the midst of record low winter temperatures in many parts of our country, every day's news seems to bring more reports of the need for and the opportunities to conserve energy.

My purpose today is to review with you the activity of Michigan Consolidated in its efforts to assist its

customers during the current period of rising natural gas prices.

When oil prices increased as a result of the oil embargo in 1973, rapid changes took place among consumers using oil based products, particularly families using oil for space heating and more generally all of us auto owners who made adjustments in our energy using habits to improve efficiency and control our energy costs.

There were immediate demands by consumers to switch to less costly alternate fuel sources like natural gas and similar demands were placed upon auto manufacturers for switches to smaller, more efficient automobiles. This transition is now well underway, however, on its heels we are approaching a potentially traumatic transition which will take place as a result of the Natural Gas Policy Act of 1978 with its phased deregulation of natural gas and impending deregulation set for January, 1985.

Particularly in the Midwest where most homes are heating with natural gas, heating costs will be increasing at an approximate annual rate of 20%-25%. Obviously, demands will be made by consumers for lower fuel prices, and in the alternative, consumers will also be looking for methods to control their natural gas energy costs.

We have the opportunity to actively provide consumers with energy knowledge and assistance to order this transitional period of rising natural gas prices. Michigan

Consolidated Gas Company has actively pursued energy conservation since the early 1970's and now has several conservation programs to aid its customers.

I believe it would be useful for me to give you a brief summary of previous conservation programs pioneered by Michigan Consolidated which were logical predecessors to our present conservation programs.

Our Company was the pioneer in initiating a home insulation program designed to enable its consumers to install adequate ceiling insulation as a relatively simple and inexpensive way to reduce heat loss and fuel consumption. Our program, which began in 1973, included an agreement by the Company to finance insulation projects and to provide information and assistance in the installation. This program became a model for many other utilities across the country and today we consider the project an unqualified success. To date, our program has resulted in the insulation of over 100,000 homes representing an annual savings of approximately 3.5 billion cubic feet of gas -- enough to heat an additional 21,000 homes for a year.

Next, we instituted a Dial-Down program in our service area, urging our customers to turn down their thermostats a few degrees as an effective method of saving energy.

Residential Conservation Services Program

Of the current conservation programs available to Michigan Consolidated customers the program with perhaps the greatest opportunity to prepare customers for energy cost increases is the federally mandated Residential Conservation Services (RCS) Program. This program is being implemented pursuant to the National Energy Conservation Policy Act which is a companion Act of the Natural Gas Policy Act.

This program provides upon request a custom evaluation of a customer's home energy requirements. The specific conditions existing in the home are evaluated on site to determine the effectiveness of approximately thirty conservation alternatives. For each alternative, the cost of making the installation is estimated for contractor installation and in instances where conservation measures can be self-installed, a similar evaluation is made. A simple payback return is calculated for each investment which allows the consumer to evaluate those measures which are both cost-effective and within financial constraints.

During the presentation of the results to the customer, energy auditor personnel review low cost - no cost conservation practices with the customer as well as those measures that can be self-installed. Manuals are provided with step-by-step instructions for each type of installation. Conservation kits consisting of sample items such as caulking,

weatherstripping, duct tape, water flow restrictors and electric outlet insulators are left with the customer so they can immediately start their own conservation projects.

Customers interested in seeking installation assistance from private contractors are provided with bidding procedures and lists of local contracting companies which perform the conservation measures discussed in the program. Lender arrangement services are also available for customers seeking financial assistance to begin a conservation project.

Once the Home Energy Analysis is complete, Michigan Consolidated provides Conservation Services representatives to answer subsequent questions regarding program measures and their installation. Lastly, for those customers who are apprehensive about performing their own installations or even having work performed by contractors, inspections of completed work are also available under the program. All furnace retrofit installations performed in accordance with the program are also inspected.

Michigan Consolidated has not yet evaluated the results derived from this program, however, there is a clear indication that savings will result based upon our exceptional early response to the program. Michigan Consolidated began offering Home Energy Analysis services in mid-1981. To date approximately 60,000 customers have requested participation in the program. In some communities, our response rate is as high as 11% of the customer base. Of the eight utilities

in the State of Michigan providing RCS services, we are collectively approaching a total of 200,000 customer requests for participation in the program.

Most customers are aware of some of the conservation measures and practices presented in the program, but our experience has indicated that few customers are aware of the value of conservation.

As we proceed with the program I see it taking on an even greater role at a lesser cost. Additional audits are available under the program in two yea. intervals, and upon reevaluating the customers home we can eliminate the majority of the audit cost which is attributable to measurement of the home and evaluation of its construction.

In the future, auditors will be able to devote attention to the "big ticket" items discussed in the program. For example, within the next several years, replacement of home heating systems and water heaters with high efficiency units as well as solar energy systems will become cost-effective.

Presently, the RCS Program characterizes these large expense items as having long payback terms. These results properly direct the customer to other more cost-effective measures, however, as we experience 20%-25% annual increases in gas cost, the savings provided by the installation of new equipment will provide attractive investments. The role of the energy auditor will be expanded as customers

seek explanations of improvements in new state-of-the-art equipment and customers will find themselves confronted with evaluating energy investments and comparing their dividends to traditional financial investment dividends.

We have seen a signficant decline in the average consumption of our residential customers since the mid-1970's totalling approximately 17%. With the opportunities available to customers and the proper guidance provided by the RCE Program, we believe that the majority of potential conservation in the residential market is yet to be experienced.

Interest Free Conservation Program

Recognizing that each of Michigan Consolidated's early conservation programs were directed towards reducing the heating requirements of the customer's home, it followed that each reduction created an overcapacity in the customer's heating system. Consequently, we focused our attention on the furnace, the furnace flue and the chimney to determine where additional energy could be conserved. In 1975 we implemented a test program to determine the effectiveness of five different devices designed to improve the efficiency of furnaces and reduce home heating loss through chimneys.

Prior to our field test we conducted theoretical studies of heat loss and energy waste on hypothetical heating systems. Our engineers determined that significant amounts

of interior warm air were lost through flues and chimneys and also concluded that the furnaces themselves were not operating as efficiently as possible.

After analyzing these hypothetical cases, we turned our attention to what might actually be happening in terms of furnace operation in our service area. We found that the majority of furnaces are oversized for the homes they heat and that the majority of chimneys are likewise oversized.

The chimney oversizing is simply explained by the fact that building codes specifying chimney and flue sizes were adpoted when most homes were heated with coal. Larger chimneys were provided for better combustion of coal while assuring strong drafts to prevent chimney fires. Obviously today few homes are heated with coal, however, building codes continue to require larger than necessary chimneys and flues.

Furnaces were oversized, relative to the size of the house, simply because energy was cheap and plentiful, and builders wanted to avoid possible complaints that homes were not adequately heated. Little incentive existed with relatively inexpensive fuels to critically evaluate furnace sizes and complimentary flue and chimney sizes.

Having made the determination that most furnaces are oversized and that most chimneys are too large, we began field tests of five different devices on the heating systems

of approximately 200 volunteer Company employees.

The devices tested included a Michigan Consolidated designed flue restrictor which is an adjustable metal plate that is installed directly into the flue pipe. When fastened in place it becomes a permanent fixture and reduces the diameter of the flue and the potential draft of the chimney. The second device was a vent damper which closes the furnace flue whenever the furnace is not operating, thereby retaining heated air within the home.

The remaining three devices were installed on the furnace and were designed to improve operating efficiency. The first was a two stage gas regulator which adjusted gas flow to maximum r tes during the peak heating season and to reduced rates during fringe heating months. The second device was a permanent reduction in the gas flow to the burner to properly size the furnace output to the requirements of the home. The last device was an electronic ignition to replace the constantly burning gas pilot.

The results of our test indicated that flue restrictors in combination with furnace derating and flue dampers are the most cost-effective installations.

In 1977, Michigan Consolidated submitted an application to the Michigan Public Service Commission requesting to broaden the terms of its existing ceiling insulation program to provide loans with reduced finance charges for ceiling insulation as well as furnace retrofit devices. Final

authorization to implement the program was received in 1981 after hearings were interrupted to perform further testing of the furnace devices. The resulting program is now known as the Interest Free Conservation Program.

Michigan Consolidated has secured a patent for its design of the flue restrictor and is currently in the process of seeking licensing agreements for the manufacturing and distribution of the device in the market place. Presently, flue dampers are being offered as furnace retrofit devices under the Interest Free Program.

The Interest Free Program provides no interest financing for two of the most cost-effective energy conservation measures -- ceiling insulation and furnace retrofit devices. The installation costs to be financed can be repaid by the customer over a period of up to five years. Loans are available for both contractor installed or self-installed insulation and contractor installed furnace retrofit devices. Loans are available up to limits of $1,000 for contractor installed insulation, $750 for self-installed insulation and $500 for furnace retrofit devices. Combinations of the above limits for both measures are available up to $1,250 and $1,500.

Upon request, Michigan Consolidated furnishes customers with lists of participating contractors to perform services and/or lists of participating suppliers for customers seeking to install their own insulation. Customers are also furnished with applications for the program together with

forms with which to obtain cost estimates from contractors or suppliers. Customers are urged to obtain several bids before submitting applications. All work performed under the Interest Free Program is subject to post-installation inspection by Michigan Consolidated.

The cost-effectiveness of the entire conservation program as well as the cost-effectiveness of the individual installation is an obvious concern of Michigan Consolidated. Loans under the program are available to all residential heating customers, however, certain qualifications must be met for participation.

Existing State regulations for utility financing programs require that cost-effective loans return a customer's investment in seven years or less. Implementation of this guideline in the program requires that customers have an existing level of insulation no greater than 2-1/2 inches to automatically qualify for the program. Other customers with greater levels of insulation are required to participate in the RCS Program to demonstrate that the addition of insulation will return their investment within the seven year period.

Customers desiring to install furnace retrofit devices must also meet the cost-effective test which requires that investments be returned in seven years or less. At the time our program was being reviewed for implementation, calculations were made using the estimated cost of furnace retrofit installations, the cost of gas, and the fuel savings

to determine that customers with levels of heating consumption equal to or greater than 152 MCF per year would qualify for the program.

Michigan Consolidated will submit a reconciliation of program costs to the Michigan Public Service Commission each year and at that time we plan to reevaluate the limits for customer eligibility in the program. It is our expectation that prices of natural gas will increase at greater rates than real prices for installation of conservation measures. Should this occur, a greater number of our customers will be eligible each year to participate in the program and obtain interest free loans.

To further expand the general applicability of the program, interest free loans are also available to customers occupying rental propery. Tenants are eligible for program participation upon approval from the owner and his/her agreement to guarantee repayment of loan in the event of default.

The Interest Free Conservation Program serves its primary purpose of reducing the overall cost of utility service by securing gas supplies through conservation at costs less than energy from incremental sources. Cost estimates for the program and savings derived from the conservation installations demonstrate that gas volumes conserved through conservation during the term of the program would cost several times less than projections of the cost

of gas from suppliers.

The cost-effectiveness of the program is significantly aided by the establishment of a wholly owned subsidiary of Michigan Consolidated called MichCon Conservation Company through which the program is operated. The subsidiary permits the conservation program to be financed independently of Michigan Consolidated's capital financing program and allows the program to be financed using a higher degree of leverage to reduce program costs. Additionally, the subsidiary uses a cash basis form of tax accounting which provides several significant tax benefits as opposed to the accrual method of accounting used by Michigan Consolidated.

Michigan Consolidated will recover interest charges, administrative costs and a 15% return on invested equity through a uniform surcharge on all rate schedule gas sales. The current level of surcharge will amount to an approximate customer charge of $.70 during the first year of the program.

The start of the program was marked by distribution of program announcements in October, 1981. To date we have received approximately 13,000 inquiries and have targeted approximately 20,000 installations for the first year.

Michigan Consolidated's Interest Free Program was not per se designed to augment the RCS Program. However, it is rather obvious that the combination of the two programs provide the customer with knowledge and direction while at

the same time offer financing arrangements for two of the most cost-effective conservation measures that have general applicability throughout the service area.

Insulation Outreach Program

While our existing conservation programs certainly provide opportunities for customers to engage in energy conservation, we have found that many low income customers notwithstanding the attractive programs offered and educational assistance available through the Residential Conservation Service Program, still lack the financial capability to make conservation investments even at no interest. We are aware that the consumption of energy is particularly a problem with many of our low income customers. We have found that their residences are often larger, older structures that are not efficient and require considerably more energy to maintain than newer, smaller, more efficient homes. It is to this group that we have directed our third conservation program called Insulation Outreach.

This program provides an RCS analysis and ceiling insulation at no charge to qualifying customers. Those customers receiving Michigan Department of Social Services assistance or meeting low income guidelines are potential participants. Installations of insulation are made by participating contractors or the customer can choose to make their own

installation, in which case arrangements will be made for the insulation to be delivered. In self-installed instances, the customer is provided with an incentive fee of $50 following satisfactory inspection of the installation.

This program has been jointly proposed to the Michigan Public Service Commission by Michigan Consolidated, Consumers Power Company and Detroit Edison Company, the three major gas and electric energy suppliers in the State of Michigan.

Participation by Michigan Consolidated will take place in two phases. The first phase of the program is underway and will continue for one year or until Michigan Consolidated has expended $2.0 million, whichever occurs first. The costs associated with the first phase will be deferred in accordance with a temporary accounting order issued by the MPSC in July, 1981.

Recovery of any amounts expended by Michigan Consolidated for the costs of the first phase of the program is contingent upon receipt of MPSC approval of such recovery. MPSC hearings on the application for approval have concluded and an order is anticipated in mid-1982. Approximately 5,000 customers will receive free insulation in the first phase of the program.

The proposed second phase will commence with the issuance of an order by the MPSC authorizing Michigan Consolidated to implement a uniform surcharge on all rate

schedule gas sales to recover the costs associated with the program. Phase two of the program would remain in effect for two years or until Michigan Consolidated has expended a total of approximately $7.5 million for both phases of the program.

The greatest benefit to be derived from this program will obviously be the conservation of energy. This effort will extend the life of our existing energy resources. The cost of all energy will continue to rise and as we add new sources the cost will be at premiums. Existing energy resources are our least expensive supply sources and extension of their availability will keep costs to all our customers at their lowest level.

By making more efficient use of our existing energy supplies we delay the need for supplemental resources which require large capital investments which result in high unit energy costs.

Further, all customers share in the burden of Company bad debt expenses. Through this conservation effort we can direct our attention to major contributors of these expenses and ultimately reduce the level of cost increases to all consumers.

We view the Insulation Outreach Program as an opportunity to assist low income customers on proper conservation techniques which they can use to control their energy use and maintain utility bills at manageable levels.

We are encouraged by the early level of participation in this program and we look forward to similar cost-effective benefits derived from our other programs.

As a public utility, Michigan Consolidated has an obligation to furnish gas service in areas where it is franchised. Needless to say, the chief element to furnish adequate service is gas supply. The conservation programs I have discussed will certainly provide gas volumes to supplement our existing supply and serve new customers, however, conservation is clearly not the whole answer to our supply needs. If there is no underlying gas supply there is nothing to conserve. Conservation needs to be added to effective efforts to maintain adequate natural gas supply.

Michigan Consolidated, like other gas utilities in Michigan, depends primarily on interstate gas pipelines for its supply. We earnestly look to the Federal Government to take appropriate action to maintain natural gas production in the United States to meet the needs of all our residential, commercial and industrial customers now and in the future.

In addition, Federal support is needed to preserve the gas volumes conserved by the types of programs I have discussed. Under existing statutes, there is a risk that conservation may reduce utility gas supply.

Notwithstanding current levels of gas supply which are adequate to meet consumer demand, natural gas continues to be consumed in greater volumes that it is produced. In

time, without a change in this relationship, we will again confront curtailments of gas supply.

Current pipeline curtailments are based upon customer end-use. Somewhat oversimplified, end-uses considered from highest priority to lowest are residential, agricultural, commercial, industrial processing and feedstock, and other remaining requirements. The pipeline's limited gas supply is shared among its customers in accordance with these end-uses. Distribution companies with proportionately more high end-use sales and proportionately less low end-use sales receive proportionately more gas.

By definition, successful residential conservation programs would reduce the volume of gas a utility sells to its highest priority customers. Conservation programs might also enable utilities to avoid or defer curtailment of lower end-uses. It could therefore place conservation conscious utilities in a worse position than other utilities that have not conserved gas, both in pipeline curtailments and in the potential allocation of new pipeline supplies.

To date, gas distribution companies have not been penalized for conservation measures because pipeline curtailment plans have been based upon earlier fixed based periods.

Unless a utility which supports gas conservation measures can retain the gas supply conserved, conservation may not be such a good idea. There is no benefit to a

utility from conservation if it loses gas from other sources. And there is no benefit, or at least a greatly diminished benefit to the utility customer who conserves, because the loss of supply to a utility will reduce its potential sales and increase the customers rates as fixed costs are spread over fewer gas volumes. Again we look to Congress to ensure that the utility which conserves gas may continue to retain that gas for the future benefit of its consumers.

I thank the Subcommittee for this opportunity to appear before it and to discuss a matter we believe is of significant importance. I want to assure you that we will continue our work to develop conservation programs that will assist our customers to control their energy costs while securing gas supply at costs that we believe will be advantageous to all our consumers. If there are any questions, I will do my best to answer them.

Mr. HARKIN. Thank you very much. Interesting testimony. I am sure we will have a lot of questions.

Next, I'd like to turn to Mr. Weston D. Birdsall, general manager of the Osage Municipal Utility, something a little bit closer to home here in Osage, Iowa.

Mr. Birdsall, thank you again for coming through this inclement weather to be here and without objection your testimony will be made a part of the record in its entirety.

Again, please proceed as you so desire.

STATEMENT OF WESTON D. BIRDSALL, GENERAL MANAGER, OSAGE MUNICIPAL UTILITIES, OSAGE, IOWA

Mr. BIRDSALL. I am sure most of you know where Detroit and Madison are, but you may not know that Osage, Iowa, is in northeast Iowa, about 20 miles from the Minnesota border—we are a town of about 3,800 people. We have a municipal utility with about 2,000 electric meters. Compare that with 300,000 electric meters. We have 1,500 gas meters; compare that with 1 million gas meters represented on this panel, so you are going to think small. However, it is all a relative thing. We purchase our gas from the Northern Natural Gas Co. pipeline, and we get most of our electricity from Dairyland Power in LaCrosse, Wis.

However, we have a diesel-generating plant in Osage for use during emergencies and shortages and we use this frequently during the year. This plant must be able to carry our entire load.

I would like to work from this graph for a bit.

I made this graph in 1974. It depicts our peakload increase up to 1974; the straight lines are generating capacity. From 1974, if we continued with our growth of peakload, we would—and this is a projection here of 7.2 percent—have to double our generating capacity once again by 1983-84. We just got through doubling it in 1974.

So at this time, we said: "What would happen if we could hold that curve, at 3 percent instead of 7.2 percent?" This was an arbitrary figure of 3 percent that we used.

We decided to try to hit a 3-percent growth in peak demand. These yearly dots indicate that we have done so. Fortunately, we have held below the 3 percent. In fact, if you will notice, now we're at zero growth on our peak demand.

If we could continue at 3 percent or less, it would mean that we would not have to put in additional generation capacity until 1994, or thereabouts. I will refer back to this chart later.

We are still adding meters. We have a growth of about 1½ percent on meters each year.

Now let's take a look at our load. Remember, this is peak demand [indicating]; this is load [indicating].

The first half of this decade, our load increased 38 percent. The last 5 years, only 2 percent; and all of this was due to industrial growth. One new industry came in 1974. In 1981, we were at this point [indicating], so we are still experiencing load reduction. One-third of our reduction last year was from conservation in our own plants.

Incidentally, all of the growth that we had on load in the last 5 years we can attribute to three of our four largest industries.

Our gas usage has also decreased appreciably during this same period. Now, based on degree days, our residential customers are using 36.4 percent less gas now than 6 years ago. This is based on the period from September to December 15, 1975, and this year.

Our commercial customers are using 40 percent less gas. With 80 cents out of every dollar collected from our natural gas customers being sent out of State, our conservation program is keeping at least a quarter million dollars per year within our community of 3,800 people.

In an energy-deficient State like Iowa, we need to keep every dollar possible within our towns and cities and in the pockets of the consumers. In reviewing our methods of reducing our electric demand, I should make it clear that not all of the methods which have worked for us may necessarily work for others. But some of the ideas we have used could certainly be used by all others.

First of all, there is no quick fix. A conservation program takes a lot of perseverance and work. In the September 2, 1980, issue of The Wall Street Journal, there was an article entitled, "Most Utilities Support Conservation With Much Talk But Little Action." It is a pleasure to be here with these two gentlemen because these people are acting and I think their programs are tremendous. I am really impressed with what these people are doing.

Much action is needed to convince customers of the need for conservation. It isn't quite as hard today as it was, say, in 1974. We found at first that the people were unresponsive to this new idea. We kept receiving complaints about increased rates and we were asked repeatedly what we were going to do about their high bills.

We had to convince them that the responsibility for the size of the utility bill lies primarily with them, the customers. We deliver gas and electricity to the meter only. From there on, it is the individual responsibility to control the usage and the size of the bill. But we said we would help him reduce his usage with our program of consumer assistance. This has been one of the primary keys to the success of our program.

We feel that if an effective program, which emphasizes the customer's responsibility is undertaken, he is going to make a personal commitment without asking for a handout. I am going to give you some of the ideas and projects that we have used. In 1974, we didn't have much gas available for new customers.

In 1975, we said that we would take on new gas customers only if they would meet our insulation specs. They had to have an R-24 in the ceiling, an R-14 in the walls, and storms on the windows and doors. We have not rescinded this. No customers today, whether it be retrofit or new house, get gas in our community without meeting these insulation specs It has been very effective.

We have added 20-25 percent more heating customers during this period. Added insulation has also had a noticeable effect on our air-conditioning usage in the summer.

We used many articles and ads in the newspaper and we also used a bimonthly newsletter which is very effective. In a small town, it is particularly easy to do. Every 2 months, we send out a

letter, and it always has something in it on conservation. We also try to explain why the bills went up.

We gave talks on insulation to any service group that would ask us. I talked to groups as small as eight people in a home. We reached 15–20 percent of the adults in Osage by doing this.

For those who "just can't be using that much electricity," and we have all heard this, we have a gimmick, the test meter shown here. It was built by one of our meter readers. A person comes in and says, "I don't understand why I am using so much electricity. There has to be something wrong with the meter."

So we say, "Well, why don't you go home, take this with you, plug this in to that automatic defrost refrigerator or your dehumidifier or block heater, plug this in where that appliance is presently plugged in, plug that appliance over here in the meter, and then check it for a week and we'll tell you what that costs." We have eight of these in our small town. Five of them are used for electric water heaters, which we wire in for them.

We've changed a lot of water heaters as a result of this, and we have made friends. We have people who wrote to the Iowa Commerce Commission complaining about our rates until they used one of these test meters and found out where the problem was. It wasn't our problem, it was theirs. This is an effective gimmick and doesn't cost very much to make.

Mr. HARKIN. Do you have a patent on that?

Mr. BIRDSALL. No; the meter reader wondered if he shouldn't. There are others on the market similar to this which I have seen advertised recently. We aren't alone with this. They are effective.

We joined with other cities in Iowa for Operation Sky-Scan, and in 3 days we showed over 1,000 adults their thermogram from the air. This was really effective because we were able to show them where they had insulation deficiencies. We found many places where they had wet insulation that they should replace. We were happy with this project.

We also gave out 2,500 of these "Home Energy Savers Manuals" that are put out by the Iowa Energy Policy Council. They are free. I think every family in Osage has one of these; maybe two. They are good. We have found them very effective.

We purchased our own handheld infrared scanner in 1981. And this is what I am talking about right here [demonstrating]. This is a $10,000 piece of equipment that I am holding here. We purchased this in 1981, and we use this in our energy auditing program. We go into a customer's house with this and scan the house. We can show him where the infiltration is, where his leaks are, we can even show him every 2-by-4 that he has in his walls, if he wants to know where to hang a picture, because there is a variance in insulation quality of wood against regular insulation.

This has been very effective equipment, because we insist that the person go with us on an audit so he can look through the scanner and see these things. He can determine for himself where the problems are. Once he sees them, he knows how effective the scanner is. We have found many, many places where people could change or correct a problem very inexpensively. We have found insulation missing completely in some houses. One person had complained about his bill. We went out with this scanner and realized

there was something wrong in the ceiling. He had 10 inches of insulation but it was still in the rolls. [Laughter.]

If anybody wants a pamphlet on this, I have some. I don't sell them, but here——

Mr. HARKIN. Can you purchase those devices, Mr. Birdsall?

Mr. BIRDSALL. Yes, they are made by Hughes Aircraft, and there are others on the market now. There are some improvements on the market which are really good. We bought this in 1981. There are perhaps some better ones, but usually more expensive.

The Iowa Association of Municipal Utilities, has one of these and this is in use most of the time. The association had a program on infrared scanning for a year, with a representative showing utility personal how to use this. I think in Iowa right now there are probably at least 10 municipal utilities owning these, some jointly with others, and using them for auditing.

Another use for this, is scanning our electric lines. We are locating bad connections and overloaded lines. There was a 69,000-volt fuse that was hot and we were able to find it because we had this scanner. This is an effective tool—my believe it is, anyway.

We started offering free energy audits in 1974, but we had very poor response; probably 1 percent, until we purchased this scanner.

With the scanner, we are getting excellent results, and we have audited as a free service, up to this week, between 23 and 25 percent of all the homes and businesses in Osage. We will audit them whether they have our gas, or not; we don't care. We have enough signed up right now, and we have a big backlog of names, so that by the end of this heating season, if we can keep going at this and if I get this back so that they can start using it again, we will have 35 percent of all the homes and businesses audited. This is a program that no one dislikes. They all like it. We have never had a negative comment on it. I don't think we have ever found a house that we went into, in which we couldn't help the people in some way, and usually in a very inexpensive way.

The people are really following up on the audits. One thing we do, also, when we are auditing, we make sure that we look at the water heater and have the customer look at it through the scanner. They just glow in here and, as a result, we are estimating that we have 40 to 50 percent of all the water heaters in our community now wrapped with extra insulation. We leave information on how to wrap it and many of them do it. This can be done for $5. Or you can buy a readymade type of jacket for $10 to $25, and they will pay for themselves fast. One fellow said he paid for his in 2 months.

We also give the customer a written report after the audit. We do more than just scan. We take the temperature of the hot water and recommend that he turn down the water heater if too high; we check his thermostat and we also check refrigerator gaskets and furnace filters, among other things.

We are also changing street lighting in our community. We are a municipal utility and we supply all the street lighting for the city of Osage free. We are changing most lighting to high-pressure sodium now. This is going to save money; it has already reduced our usage of electricity very appreciably.

We instigated a voluntary electric load management program in 1980. We received State and DOE grants which were supervised by the Iowa Energy Policy Council. We installed 650 load management devices. This particular one I am holding is the one we put on the air conditioner. This goes under the air conditioner cover. We cut off the compressor, not the fan—the fan continues to operate. We are shutting off the air conditioners—again, I say it is just the compressor—7½ minutes out of each half hour. The water heaters will be shut off for perhaps 3 or 4 hours—electric water heaters I am talking about, of course. We are doing this during our peak periods which are usually, 3 to 5 hours long, maybe 5 to 8 days a year in the summer.

We have to have generating capacity for just those peak periods; everybody does. We have to supply it. There has to be some way of reducing this. We tried this and we have been very, very happy with the results. We offered no incentive to the people, who cooperated except we told them that eventually this may hold down "your rates". We got 75 percent of the eligible people to sign up for the project. I think if we had worked harder, we could have gotten a higher percentage.

Other utilities have done the same thing. Two other municipals in Iowa house had similar results. They had no problem whatsoever with getting voluntary signup on this program.

Don't forget, we're shutting off those air conditioners and those water heaters at our convenience and those people are going along with it.

We projected that we would get a 10- to 12-percent reduction in our peak load. Results were even better than what we had anticipated. Last summer, we got a 14.7-percent reduction in peak load. We had a 4-percent due to conservation. You notice that this 1981 peak load [indicating] was a little bit less than the one the year before, and that was through conservation, alone.

Now, let me show you what happened when we put on our load management equipment and cut off these air conditioners and water heaters. Our peak load went down here [indicating]. Now, we're near to the peak load we had in 1973.

What we are saving by doing this—again we're talking in much smaller terms here—this 14.7-percent reduction in load amounts to about one megawatt of electricity. The cost of the load management equipment is about $150,000. To buy base load from a coal-fired plant, 1 megawatt today costs about $1 million. So we are saving some money and this money is staying in Osage.

Mr. HARKIN. Excuse me. You control, you shut off the air conditioners?

Mr. BIRDSALL. Yes.

Mr. HARKIN. I don't understand how it is wired up. Do you have a——

Mr. BIRDSALL. OK, this is radio-controlled to the transformer and it goes in on the secondary side to the control, itself. We control it from our plant. We have a computer there which turns these off through a specified program and the customers don't know when they are shut off.

Mr. HARKIN. Have you gotten any complaints?

Mr. BIRDSALL. Oh, yes, one.

Mr. HARKIN. One?

Mr. BIRDSALL. Yes. Usually the complaints we get are unjustified. When we explain to them what the problem is, they are satisfied. It is usually something else that is causing the problem, not our device. We have taken off, I think, two. We told the people, "Now, when we put this on, this is a voluntary program. And we will take off this control any time you say, without any question about it. If you don't like it, we will take it off." We have taken off two. I am sure I can get one of them back because he was running out of hot water, but it wasn't because of the device. The device wasn't working, so it was just one of those cases where I think one of the elements was out.

So we have not had any real complaints, and this is the delightful part of it.

There is an article in Electrical World which I think is extremely interesting but unfortunately I didn't put it in my prepared statement. I didn't think about this until too late, but this is in Electrical World, September 1981. It says that the United States has a very low generation capacity factor compared with other countries.

It is apparent that at least 8 percent greater kilowatt hour output should be obtained by using various forms of load management.

And that's what we're talking about, load management. We got more than 8 percent.

Such as time-of-use rates, off-peak hot and cold storage and peak shaving. This means that utilities should, as a whole, find it possible and profitable to generate 8 percent more kilowatt hour sales from their existing or under-construction power plants.

And the nice part of it, this is noninflationary. When we are talking about $150,000 as opposed to $1 million, this is noninflationary and I like it.

During the course of our 2-year study on this program, we were the first ones in Iowa to do this, as you know, and as I mentioned, we had a DOE grant to do it, and we have spent a lot of time with other utilities. In these 2 years, I was contacted by 24 other utilities, some from Iowa, some from other States. I spent as much as 5 to 6 hours with these people when they came in. They came by plane or auto and we would spend a day together if necessary.

Of these 24, 12 have now ordered or already have installed their own load management equipment. So you see what's happening. In fact, the interest was so great that in November, the Iowa Association of Municipal Utilities decided to have a symposium or workshop on load management. This was a late-scheduled meeting but we had 80 people preregistered and we ended up with 140 people at the Savery Hotel for a one-day symposium. We had 14 suppliers come in from all over the country and set up booths. It was very, very effective and I know that there were some utilities that went out of there and bought equipment. We know that orders were signed.

One other thing we did—this is a gimmick, I guess, but we like gimmicks. We did go along with the Iowa Energy Policy Council on an auto program last summer where they check the emissions from automobiles. Would you believe that in 1 day we checked 419 vehicles for auto emissions? We had lines that you wouldn't believe. We

told the people it would only take 2 minutes. It did when you got to the end of the line, but it took 20 minutes to get to the end of the line; 419 was the largest number that anyone had in the 2-year program since they started this auto energy program.

We are presently planning a schoolwide energy conservation program and we intend to include all the students of our community school district. We have the assurance of cooperation from the superintendent and the principals and they are very enthusiastic about doing something.

We also have the help and the cooperation of both the State and the area education agencies and the extension service from Ames with whom I met yesterday. We hope that some of these ideas will help others. It takes a combination of many ideas for a successful program. We are convinced that demand growth will not return to the 7.2-percent that we had before, especially as rates continue to rise, and this is going to have its effect, of course.

We believe now that our growth rate of 3 percent is too high, and, even then, that is half what the Iowa generation study projected in 1979. We are going to work for 1 percent, or less, average growth in electric demand which we feel will save our customers millions of dollars in reduced capital expenditures, and this money is going to remain in our town of Osage.

Thank you.

Mr. HARKIN. Thank you very much. That is very interesting testimony.

[The prepared statement and biographical sketch of Mr. Birdsall follow:]

PREPARED STATEMENT OF WESTON D. BIRDSALL, GENERAL MANAGER, OSAGE MUNICIPAL UTILITIES

THE OSAGE, IOWA CONSERVATION PROGRAM

Electric utilities have historically operated according to the principle that "a dollar burned is a dollar earned". The more electricity we could sell, the more revenues or the lower the rates could be.

These days are over and we are now seeing a change in this approach for growth in demand is no longer a sure route to higher earnings and/or lower rates.

One of the utilities now most conspicuous in its change is General Public Utilities Corporation, holding company for Metropolitan Edison, owner of the TMI nuclear plant. Two years ago they estimated their demand would grow 3% per year, however they have decided to spend $580 million over the next 10 years in an energy conservation program which is designed to cut their growth rate to 1.5% by 1990. They estimate over the next 30 years this will save $2.1 billion in new plants and fuel to run them.

The Osage Municipal Utilities serves the city of Osage with 2000 electric meters and 1500 gas meters. Gas is purchased from Northern Natural Gas Company and most of the electricity is purchased from Dairyland Power Cooperative, however we have a diesel generating plant for use during emergencies and shortages.

In 1974 after doubling our electrical generating capacity it was obvious that if our growth continued at 7.2%, we would need to increase our generation capability by 1984. We set a goal of 3% growth at this time which would delay construction by at least 10 years. We set this

goal in spite of annual growth of 1 1/2% in new meter installations and growing industries. (Fig. 1)

It was at this point we started a very active conservation program. We have held our peak demand below the 3% growth curve and in fact during the last three years are at zero growth in spite of three of our four largest industries increasing usage during this period. During the first 1/2 of the past decade our load increased 38% but only 2% in the last five years. Growth of our three largest industries accounted for more than this. (Fig. 2)

Our gas usage has also decreased appreciably during this same period. Based on degree days our residential customers are using 36.4% less gas now than six years ago, the commercial customers use 40% less. With 80¢ out of every dollar collected from our natural gas customers being sent out of state our conservation program is keeping at least $250,000 per year within our community of 3800 people. In an energy deficient state like Iowa we need to keep every dollar possible within our towns and cities -- in the pockets of the consumers.

In reviewing our methods of reducing our electric demand I should make it clear that all the methods which have worked for us may not necessarily work for others, but some of the ideas we have used could certainly be used by all others.

First of all there is no quick fix. A conservation program takes a lot of perserverance and work. In the September 2, 1980 issue of the Wall Street Journal there was an article entitled "Most Utilities Support Conservation With Much Talk But Little Action". Much action is needed to convince customers of the need for conservation.

We found at first that the people were unresponsive to this new idea. We kept receiving complaints about increased rates, and we were asked repeatedly what we were going to do about their high bills. We had to convince them that the responsibility for the size of the utility bill lies primarily with the customer, we deliver gas and electricity to the meter only. From there on it is his responsibility to control the usage and the size of the bill, but we said we'd help him reduce his usage with our program of consumer assistance. This is one of the primary keys to the success of our program. We feel that if an effective program which emphasizes the customer's responsibility is undertaken, he is going to make a personal commitment without asking for a handout.

Some of the ideas and projects we have used are as follows:

*1. Insulation specifications for any new customers getting gas for heat. No house or business has received gas since 1975 without meeting our specs which require 8" of insulation in the ceiling, 4" in walls plus storm windows and doors. We have added 20% more heating customers since then. This has had a noticeable effect on air conditioner usage as well and is one reason our electric load had held constant.

*2. Many articles and ads in the local news media always emphasizing the value of conservation.

*3. A bimonthly newsletter which always has information on conservation. We get the best readership through this media.

*4. Talks on insulation to any service group that would schedule it. We reached 15 to 20% of all the adult population of Osage.

*5. For those who "just can't be using that much electricity" the use of a free test meter which will record individual appliance or water heater usage.

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*6. Joining with other cities in Iowa for operation "Sky-Scan". We showed almost 1000 adults the aerial thermogram of their house or business. In addition we used Northern Natural Gas Company's computerized audit program and ran 250 of these in three days. We also have given out 2500 Home Energy Savers Manuals printed for the Iowa Energy Policy Council.

*7. The purchase of our own hand-held infra red scanner with Cedar Valley Electric Cooperative. We have offered free energy audits since 1974 but had disappointing response (about 1%). With the scanner we are getting excellent results. We have audited as a free service 20% of the homes and businesses, and we have enough signed up to increase this to 30% by the end of this heating season. The response to this type audit is much greater than our previous audit, owners are following up, really doing something to correct their problems. We insist that the owner accompany us during an audit. That way the individual can look through the scanner and see where the problems are. We are showing the customer the high heat loss from his water heater and as a result many water heaters now have extra insulation jackets. (We estimate 40 to 50%)

*8. Use of the infra red scanner to locate loose or corroded electrical connections on our distribution system. This is reducing line loss and eliminating possible outages.

*9. Changing of street lighting which is furnished free to the city. Fluorescent, incandescent and mercury vapor lamps are being replaced with high pressure sodium lights.

*10. Instigation of a voluntary electric load management program. With state and DOE grants supervised by the Iowa Energy Policy Council we have installed 650 load management devices designed to cut off air conditioners 7 1/2 minutes out of each half hour during each three to four hour peak period five to eight days each summer, and further designed to cut off electric water heaters for those entire three to four hour periods. There was no incentive to those who allowed us to install devices, it was strictly a voluntary program yet 75% of the people allowed us to install the devices.

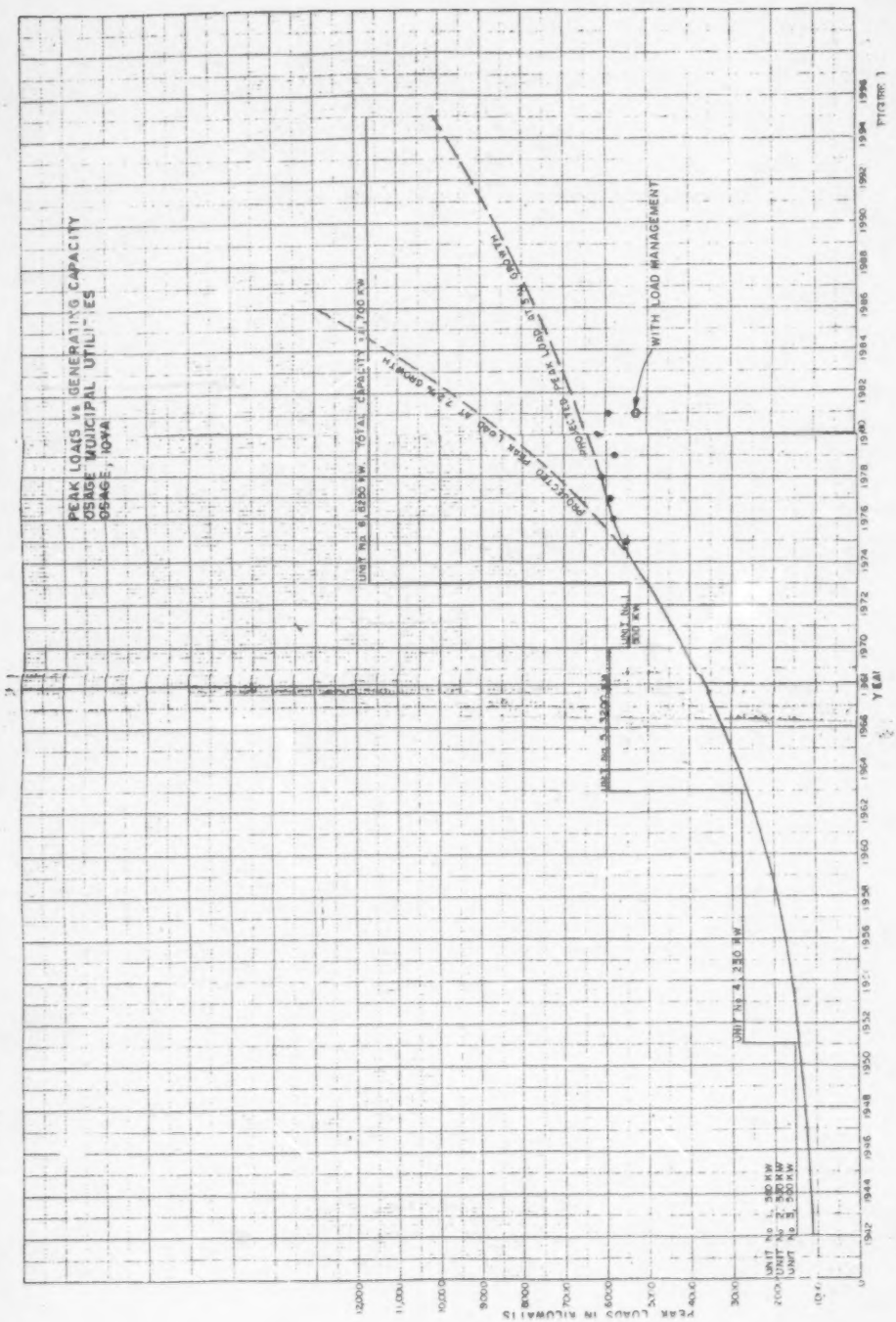
Reduction in peak load was projected at 10 to 12%. Results were even better with a 14.7% reduction, 4% of which was through conservation. This program will likely delay additional equipment installation to the year 2000 barring unforeseen changes such as a new large industry. We would welcome this "problem". These programs have put us in the position of being able to handle the utilities for new industries interested in our city. This reduction of 14.7% is almost 1 MW during peak periods. Cost of this load management equipment is $150,000 to $200,000. To purchase base load capacity from a coal plant today would cost $1,000,000 per MW.

During the course of our load management project over the past two years we were contacted by 24 other interested utilities, 12 have now ordered load management equipment. Because of this interest the Iowa Association of Municipal Utilities had a Load Management Workshop in November in Des Moines, where 140 interested people registered, 14 suppliers had booths.

*11. Although it had nothing to do with our utility conservation program we participated in the Auto Audit Program sponsored by the Iowa Energy Policy Council in August of last year. We checked 419 vehicles, the largest number checked at one location in the two year program.

*12. We are presently planning a school wide energy conservation program which will involve all students in the Osage Community School District. We have the assurance of cooperation from the superintendent and school principals as well as the state and area education agencies and the Extension Service.

We hope some of these ideas can be used by others, it takes a combination of many ideas for a successful program. We are convinced that demand growth rate will not return to the 7.2%, especially as rates continue to rise. We believe now, our 1974 goal of 3% increase in growth, is too high (even then it was almost 1/2 of the 1979 Iowa Generation Study projection). We're going to work for a 1% or less average growth in electric demand which will save our customers millions of dollars in reduced capital expenditures and this money will remain in Osage.


PEAK LOADS VS GENERATING CAPACITY
OSAGE MUNICIPAL UTILITIES
OSAGE, IOWA
WITH LOAD MANAGEMENT
UNIT No. 4, 230 KW
UNIT No. 1, 500 KW
UNIT No. 2, 500 KW
UNIT No. 3, 500 KW
PEAK LOADS IN KILOWATTS
YEAR

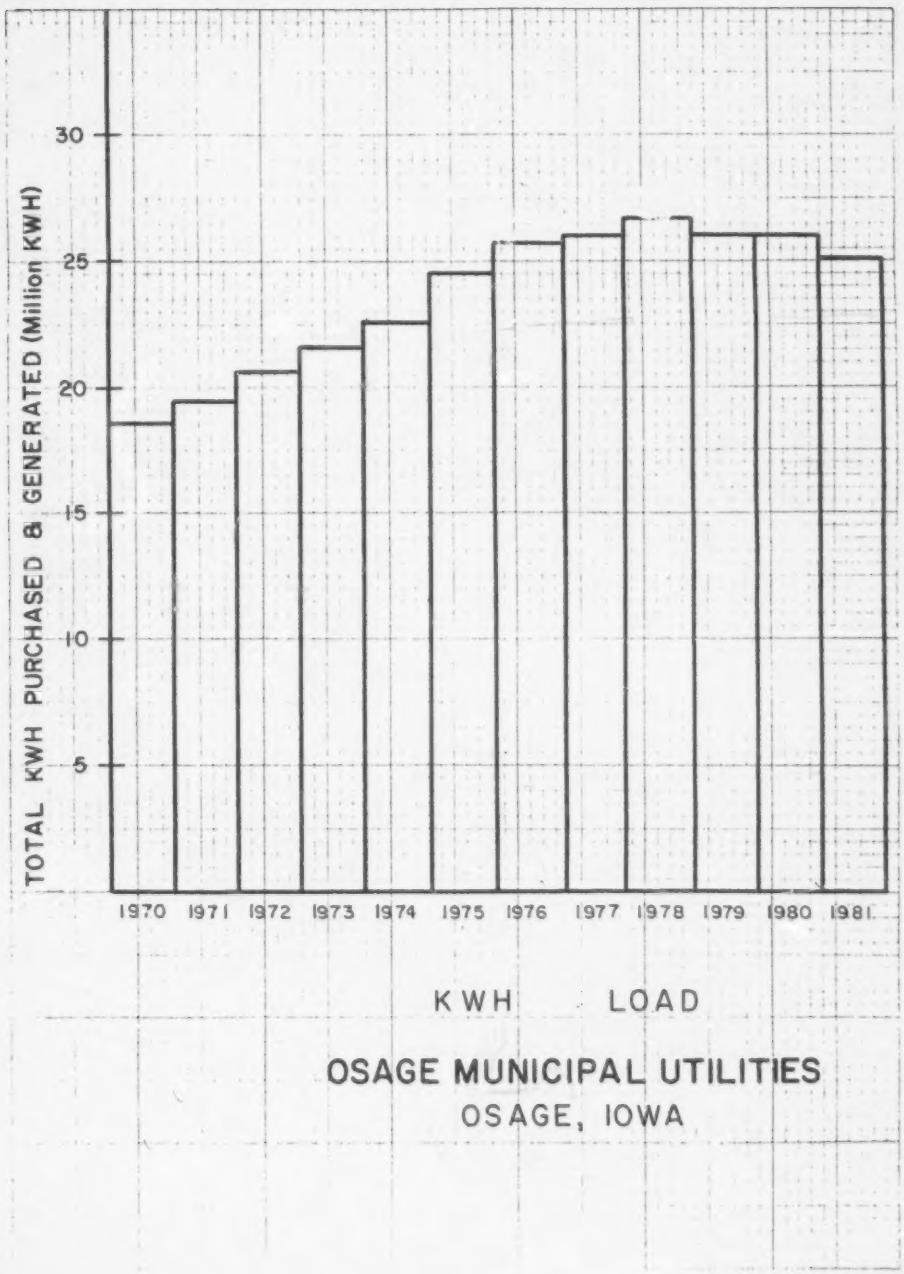

TOTAL KWH PURCHASED & GENERATED (Million KWH)
30
25
20
15
10
5
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981
KWH LOAD
OSAGE MUNICIPAL UTILITIES
OSAGE, IOWA

FIGURE No. 2

BIOGRAPHICAL SKETCH

Weston D. Birdsall, General Manager
Osage Municipal Utilities
Osage, Iowa

Weston D. Birdsall
General Manager of Osage Municipal Utilities - 10 years
Previously in LP gas business in Osage
Graduate University of Nebraska - BS in Mechanical Engineering
Past President Iowa LP Gas Association
Past President Iowa Association of Municipal Utilities
Recipient of Iowa VFW 1981 Community Leadership Award.
Recipient of DEED Energy Innovator Award by American Public Power Association - 1981
Recipient of President's Award for Energy Efficiency - 1980

Mr. HARKIN. That device, that load management device, do you have a patent on that?

Mr. BIRDSALL. No, you can buy these. This one came from the Scientific Atlanta Co. in Georgia. In the last 2 years, there were 800,000 of these installed in the United States. That is how fast this is growing. Everybody is getting into the act. Westinghouse, Scientific Atlanta, GE——

Mr. HARKIN. What does one cost?

Mr. BIRDSALL. This particular device, I think, is around $40—something like that. You have to put the whole thing together and see what your cost is per kilowatt hour reduced. That is the only way I can look at it realistically.

We bought a little over $100,000 worth of equipment for the 650 customers. And the equipment is good. I am not plugging Scientific Atlanta. There is other equipment on the market, too, and it is good; it works. We've had very, very few problems with it.

Down in the South is where they first started using this. In fact, that is where I got the idea, from Albany, Ga.—Albany, Ga., is a city of 100,000 people. It also has a municipal electric utility. It cost $450,000, approximately, for the equipment that they put in. The first hour they used it, they saved $500,000 on demand charges because they were buying all their power.

Mr. HARKIN. I am sure.

Mr. BIRDSALL. So this thing is going. Some of the largest companies like, Dairyland Power, the people we buy our power from, are spending $34 million right now for load management equipment. Pacific Gas & Electric is going on and many of these large utilities now are going for load management. I think it is very, very effective and I think it is going to work.

Mr. HARKIN. When I get home, back to Washington, I am going to ask my utility why they don't start doing that. I live in a suburb of Washington where it is very hot in the summer and everybody has their air conditioner going full blast in the summer.

Mr. BIRDSALL. Right.

Mr. HARKIN. And I am going to inquire as to why they haven't done something like this.

Mr. BIRDSALL. Maybe they will start it.

Mr. HARKIN. Well, thank you very much. A lot of good testimony, a lot of good things to think about.

Before I start asking questions—I know the time is slipping away— but I think it is interesting, this article in the paper yesterday, and I think it's probably appropriate that I read a few parts of if before I begin to ask some questions.

The article goes like this: It says:

> Iowans will dramatically reduce their natural gas use if prices triple as expected, Iowa's top utility regulator predicted Wednesday. But his view was disputed by Iowa's major gas supplier. Andrew Varley, chairman of the Iowa Commerce Commission, told a legislative hearing that new research shows customers could cut their gas use by up to 40 per cent as prices soar. And that could mean there won't be much demand for gas in the controversial Alaska pipeline or for high-priced gas being purchased for the future by suppliers like Northern Natural Gas Co., he said: "The issue of future demand for high-priced gas has been largely overlooked in the public debate on the Alaska pipeline, although the financial guarantees passed by Congress could leave consumers holding the bag if gas use plunges. Already consumers are committed to paying a $100 to a $150 a year by 1986."
>
> Consumers could be trapped, too, if they have no use for expensive Canadian and deep-well gas, since Northern already has signed contracts promising to purchase it. Consumers could be required to pay for the gas anyway. Customers of utilities supplied by Northern reduced consumption by 17 percent during the past decade by company figures. But Larry Deroine, a Northern vice president, said the company expects only 2 or 3 percent additional conservation a year in the future.
>
> While Northern is not expecting demand growth, the company is counting on a relatively constant demand and not a sharp decline through 1990.

I understand that Northern Natural Gas, which supplies two thirds of the natural gas in Iowa said that they are planning on a 17-percent reduction in gas use per household over the 1980's. That is for the decade; not per year.

Now, Mr. Kozyrski, you said in your area you reduced it by how much? You are planning on how much of a reduction?

Mr. KOZYRSKI. We have experience of 17 percent since 1975 or 1976, to date.

Mr. HARKIN. So 17-percent reduction just in about 5 years.

Mr. KOZYRSKI. In about 5 years; however, we think that there is—we reduced it from 195 million cubic feet to 162. We think we can get it as low as 120 to 130.

Mr. HARKIN. In the next 5 years.

Mr. KOZYRSKI. In the next 5 years. I don't know what the percentages are; 160 to 120, that's 25 percent over today's base—an additional 25 percent. I am in agreement with the comment that natural gas consumption could be reduced by 40 percent.

Mr. HARKIN. You believe that's possible?

Mr. KOZYRSKI. Presuming generally that the customer has not done much in the way of conservation, sure; and that's true. We were at approximately 200 and we think we can get down to about 120–125. That's approximately 40 percent.

Mr. HARKIN. Mr. Birdsall, I see you nodding your head. You believe that's possible?

Mr. BIRDSALL. Yes, sir.

Mr. HARKIN. How about you, Mr. Moody?

Mr. MOODY. In 1975, we made projections that we could reduce it 25 percent by 1985. A lot of people didn't believe that was possible.

We have already exceeded that and there is a lot to go yet. So something in that range would be possible, I think, depending on how high the price goes.

Mr. KOZYRSKI. And that is still maintaining existing comfort levels.

Mr. HARKIN. Would that imply, then, that the chairman of our Iowa Commerce Commission, Mr. Varley, may be right, that we don't need that expensive gas? That seems to be his implication.

Mr. KOZYRSKI. Well, that's the implication. However, I think we have got to take a look at where we are right now. Since the year 1968, industry consumption has exceeded production. So there has been a gradual decline in reserves. I don't know where we are in total, but I think we have got to reevaluate collectively where we are going to be, what the level of finding and producing new gas is, and collectively how much we can reduce from what our demand is going to be until we can then evaluate whether or not it is not such a good idea. I don't believe we can say that right now.

Mr. MOODY. The unanswered question, I think, here is the substitution factor of gas for something else. Your opening comments about 78 quads in the Nation now and maybe we can get by with 84 quads by the year 2000. I think we have to look at the year 2000, what is going to make up that 84 quads and if, in fact, we are really going after imported oil and are going to try to get that down. I think that is in my mind the unknown factor whether we have to increase the amount of gas, stay the same or let it decrease. I think that if you just looked at your existing gas customers without any switching of oil customers to gas or the potential of a transportation switch—there are some vehicles that could switch off oil onto compressed natural gas or propane which, of course, is more of a domestic resource than imported.

Mr. HARKIN. Or methane.

Mr. MOODY. This fuel switch is the unknown, which makes it difficult to say whether——

Mr. HARKIN. But, you see, here is where we, as policy planners and Members of Congress, come in. We are asked to vote on the Alaska pipeline where consumers are going to have to pay for it, even though perhaps it may not be built or perhaps we may not even need that gas at the time it is built 5, 10 years from now. We may only need that gas 30 years from now. I mean if we enact these kinds of conservation programs and stretch this time period out, there is a possibility that we may need that gas 20–30 years down the line.

During that time period, of course, new technology may come on line. We may, indeed, switch our usage in automobiles to methane, or to whatever, in that timeframe and we may decide at that point that we can put it off another 20 years. Do you see what I mean?

So why do it right now and lock in this high-priced gas when, in fact, we can do the things you gentlemen have done which, as you pointed out, Mr. Birdsall, costs a lot less money and are a lot less inflationary.

So, is it logical to put our eggs in this basket, not, of course, shutting off the possibility of getting it in the future. The gas isn't going to go away. It has been there for millions of years and it is going to be there. It is not going to dissipate into the atmosphere.

Leave it there. Let's concentrate our efforts and see what kind of a timeframe we are looking at maybe 10 years down the line or 15 years down the line.

Perhaps our economy might even be better, hopefully, by that time.

Mr. BIRDSALL. I think there is another thing that we should look at and this is the possibility—and I am going with what Dale says—we don't know where that energy is going to come from, but don't overlook the possibility of electric heat. In our area, the REC is putting in dual-fuel furnaces and selling electricity for dual-fuel heat cheaper than they can buy fuel oil or LP gas. At least it is about the same as LP gas, but cheaper than fuel oil.

Natural gas is still half of what fuel oil is. And what they'll do is, they will cut off these people—in fact, they will cut off these people——

Mr. HARKIN. Is this a heat pump?

Mr. BIRDSALL. No.

Mr. HARKIN. Electric heat?

Mr. BIRDSALL. Electric heat furnace. What they are doing is shutting these people off 4 hours a day, from 5 to 9 p.m. every day when they have that winter peak, and so they have to switch to another fuel during that period. It is saving these people money and the REC can't keep up with the number of orders they have for installing the furnaces.

Mr. HARKIN. They switch to what? Electric to gas?

Mr. BIRDSALL. They will switch from electric to fuel oil or LP, as a standby. In other words, electric is their main heat source, but they will switch over to oil or LP during those hours of 5 to 9 p.m.

Mr. HARKIN. I guess what I am missing in this whole thing and I haven't been involved in it for quite a few years now—and Dr. Frankel can contradict me if I am wrong—is that I believe electric heat is the most inefficient form of heat generation there is.

Mr. BIRDSALL. True, but I am looking, and our board is very seriously looking, at the possibility that maybe we are going to be talking about electric heat in the future.

Right now—there was an article in one of the trade magazines this month on what is happening—many are using heat pumps and I like this idea of a heat pump better. Washington, D.C., is one of the cities where the electric company is selling electricity cheap enough that they are actually in some cases now using natural gas as a standby. Can you believe that? Let's say that they don't use natural gas as a standby right now. They use fuel oil or LP. But natural gas is going up—they say that it is going to increase 25 percent a year and if we get deregulation, it is going to double. This comes from the chairman of the board of Internorth. And when that price doubles, natural gas is going to be right up there almost with the fuel oil price. When that happens, I think you are going to see some people switching to electric heat with gas as a standby.

Mr. HARKIN. Mr. Steinway.

Mr. STEINWAY. What is your base fuel that you are going to use for electricity?

Mr. BIRDSALL. Coal.

Mr. HARKIN. Of course, you know, if you have got a cheap way of making electricity like hydropower——

Mr. BIRDSALL. Well, we don't have it. We are talking about coal-fired plants.

Mr. HARKIN. That may be a possibility.

Mr. BIRDSALL. I think it is.

Mr. HARKIN. For certain areas of the country. Obviously, like hydro is for the Northwest; coal may be for——

Mr. BIRDSALL. Well, they are talking about this now in Washington, D.C., Cleveland, these areas, they are very seriously looking at this and starting to work on it. So I think this should be of real concern for the natural gas industry. They may be another Detroit. They may be pricing themselves out of the market.

Dr. FRANKEL. The American Gas Association has been holding back on decontrol for that very reason. They don't want to price natural gas out of the market by driving up the prices.

Mr. BIRDSALL. That is right.

And even Northern Natural Gas Co., who originally was very much in favor of decontrol now says, "We don't want decontrol." All of a sudden they see that they are going to price themselves out of the market.

Mr. HARKIN. It just seems to me that if, in fact, we move in that direction of using electricity for heat and even if we are using coal, the demand for coal is going to increase sharply. As that demand goes up, Wyoming and Montana and the coal companies or the oil companies that now own the coal companies, are going to start jacking up the price of coal as the demand goes up.

Mr. BIRDSALL. We can't win, can we?

Mr. HARKIN. Well, again, what you win is by being more efficient.

Mr. BIRDSALL. You bet. I agree.

Mr. HARKIN. By squeezing the most out of what you have got.

Mr. BIRDSALL. I agree, yes.

Mr. KOZYRSKI. I would like to make a comment about the comparison of gas heat to electric heat. I think by making that comparison, I think we have to look at the new electrical equipment. I think, at the same time, gas burning equipment hasn't changed significantly since it was started to be used and today I think we are seeing new gas designed furnaces, postcombustion regenerative furnaces which are approaching theoretical efficiency levels of 88 to 90 percent. The overall operating efficiency of gas equipment installed in the home ranges, if it is set up properly, 60 percent. So you are looking at existing operating ranges of 50 to 60 percent.

We can improve the operating efficiency of just that gas-fired system by 35 to 40 percent with just changing equipment. And we are looking at an installation cost of approximately $1,000 to $1,500. At the same time we are looking at new water heat designs that do the same thing. So I think when we take a look at electric heat, I think in some instances it can be useful but I think we have to take a look at the customer's entire energy costs, not just the unit cost. And I think on the whole, we will finally make the comparison.

And the comparisons have to be similar. You will find in many instances when we compare electric homes to homes heated with

gas and oil, you will find that electrically constructed homes have 12 inches, 16 inches of ceiling insulation, a 6-inch wall. I think if we go to a comparable home and put in state-of-the-art gas equipment, I think we will be looking at attractive total heating costs with natural gas in comparison to electricity.

Mr. HARKIN. Mr. Birdsall, what are the Iowa municipalities looking at in terms of municipal codes to encourage the building of homes, new construction, rental property, whether it is apartments or detached individual homes, that have to be energy efficient before you hook them up. I forget which one of you mentioned it.

Mr. MOODY. We do that.

Mr. HARKIN. They have to meet certain standards before you hook them up.

Mr. MOODY. Right.

Mr. HARKIN. Are you two doing that?

Mr. BIRDSALL. We do that, too.

Mr. HARKIN. How about Michigan? They have to meet a certain standard before you will hook them up.

Mr. KOZYRSKI. Absolutely.

Mr. HARKIN. You do that, too.

Mr. KOZYRSKI. Yes.

Mr. HARKIN. So Iowa municipalities are doing it. I understand there is a town in California—maybe others have done it, where they have said that all new homes built must have most of the glass facing the south. They are going to face the south rather than face the north. I thought that was quite unique. So now when they lay out their streets and their subdivisions, the houses face south rather than north. That is a simple little thing that makes sense. I was just wondering, are you looking at this kind of thing?

Mr. BIRDSALL. I can't say that we've done a lot on this. However, Bart might comment on some of the programs that the municipal utilities are embarked on right here in Iowa right now, which I think are good.

Do you want to say anything, Bart? Is it all right?

Mr. HARKIN. Well, I might call on him in a second. I want to finish the panel.

Getting back to a couple of specifics before we end this matter. Most of the utilities that we have heard from get a response rate on audit programs of less than 5 percent. At Wisconsin Power & Light, I understand that you are having more than 20 percent response. Why? Why are you so different than others?

Mr. MOODY. Maybe I could clarify that. I am talking about the response rate we had in our natural gas program prior to RCS. Now, we are in the middle of an RCS mailing. We have gone back to some of those same customers that we previously—but now we have to mail again to these customers we previously audited and we had a very, very low response rate to the RCS mailing. Some of these customers we have been to three and four times before. In fact, we have had some derogatory comments back from some customers, "Why are you sending me this again?" They have already had it.

So we pushed hard. We had to promote. The specifics I was giving you were the space heating customer. We are not getting a

very high response rate on RCS; very low, in fact; probably in the 1 and 2 percent preliminary on RCS mailing.

So we've got a lot done. Maybe part of it is because we have already visited a lot of these customers and they have seen it before.

Mr. HARKIN. I see. What do you think would increase the response rate, make it better? Now, Mr. Birdsall, what they do up there, as I understand it, you actually take the person in the home around with you with the scanner. That is one thing. Would that help?

Mr. MOODY. We have experimented with the thermoscan-type activities. We are not doing that right now. I would like to see some of the emphasis not on the number of audits made, not how many customers you visit, but what are the overall results and performance?

Mr. HARKIN. That's right. So we get down to the real thing which is money.

Do you believe utilities should finance energy efficiency improvements? If so, at what interest rates? Should other ratepayers subsidize efficiency improvements in my house? Suppose my house has no insulation. I am just giving you a hypothetical example. I waste a lot of energy. You come out with your scanner, Mr. Birdsall. and you say, "You are really wasting a lot of energy." And I go to the Michigan Consolidated Gas Co. and I say, "I want one of those interest-free loans to insulate my home and to caulk it, weatherstrip it, do all those things."

Who is going to subsidize that interest rate? Who pays for that? Someone has got to pay for that.

Mr. KOZYRSKI. Certainly.

Mr. HARKIN. Who does.

Mr. KOZYRSKI. The customer picks up the principal without any interest rate or at low-interest rates, demonstrate with loans available for cost-effective installations. And I think you will find that the existing interest-free programs provide loans for only those installations that are cost effective which means that they recover their investment in a reasonable period of time, and we are looking at approximately 5 to 7 years.

Now, obviously, there are program operating costs but more specifically, somebody has to pick up that carrying charge. And what we do is we charge that carrying charge to all customers of the company.

Mr. HARKIN. You spread it out over the rate base?

Mr. KOZYRSKI. For participating and nonparticipating customers and obviously the question is why should I be paying for somebody else's insulation? Well, the fact of the matter is what happens is in order to take care of natural gas—providing customers with natural gas supply, obviously some of the old wells are deteriorating, we have got to go out and find new incremental supplies. New incremental supplies are at base deregulated rates. Some are deregulated rates. And we are looking at substituting 30-cent natural gas for six-dollar, seven-dollar, seven-dollar-and-a-half gas. The incremental supplies are considerably higher. So what are we looking at? Through conservation, we can reserve those lower-priced sources of supply, extend their use over a longer period of time. We can delay when supplemental gas supplies come on.

So what we do is we look at the total cost of the program and then we estimate how much gas we conserve over the total cost of the program. And we determine how much it is going to cost us through conservation to acquire this incremental source of supply. And in many instances, in our program, we found that in order to capture this additional source of supply through conservation, the cost was between three and five times less than what it would be if we went out and purchased an additional incremental source of supply.

So we, at the time when we filed our program, we were looking at purchasing this increment through conservation at a dollar a thousand in comparison to what market prices were at three to five at the time.

Mr. HARKIN. Three to five at the time. OK, so what you are saying, then, is that all of your ratepayers are better off to subsidize the low-interest or no-interest loans that you give because it is cheaper to do that than to pay the higher rates for new incremental gas. Is that what you are saying?

Mr. KOZYRSKI. Their total cost of gas would be lower than it would be otherwise without the program. Consequently both participants and the nonparticipants benefit.

Mr. HARKIN. Mr. Moody.

Mr. MOODY. I agree with the concept that it should be cost effective, what is done, and use a couple of examples where in the Northwest part of the United States where hydropower, cheap hydro has been a source of power, many people went with electric heat.

Mr. HARKIN. Sure.

Mr. MOODY. They were predominantly electric heat out there. They didn't have the lower cost natural gas available in the area. Now, as the space heating is the primary thing that you can drastically change the amount of use on. It is a great percentage as compared to how much electricity is used for lighting or something like this. As those people weatherize, they can put in major programs in the Northwest and benefit all the ratepayers, it would be my judgment. I have reviewed some of those programs. I don't know if this is necessarily cost effective here in the Midwest.

At least in Wisconsin, we have a very, very low amount of electric heat. We are primarily a rural utility, small town, where sometimes gas isn't available, and oil heat is a major factor. We have taken the position in Wisconsin that it is not right for the electric ratepayer to subsidize and pay the cost of insulation in a home where it is oil that is being used to heat. It just drives the cost of electricity higher and higher and makes it more difficult for those people to pay.

So in Wisconsin, we are launching a program now where the State is bonding money, they are using State bonding and the utilities are helping put that money in place in the form of loans for the weatherization. We think that this is a lower cost money than what we can raise capital and we think everybody benefits in that respect.

Mr. HARKIN. I understand.

I would be glad to entertain two or three questions if anyone in the audience has any. The first hand up gets to ask the first question, I guess.

Please state your name again for our reporter.

Mr. SORTEBURG. Curt Sorteburg.

I will tell you the thing I am finding more of, and I was impressed by what some of you folks are doing. There is a backlash building now as we do better insulation and vapor barriers in walls. As we, seal up houses, carbon monoxide formation increases because of not enough ventilation. I am finding more and more of my neighbors saying, "Well, yes, I put the insulation in but I am not going to rot my wall out or asphyxiate myself." So how do you address that kind of question?

Mr. HARKIN. Can we save that question for the next panel? That is when we are going to have our housing people. We are going to have a homebuilder; let's save that question for him.

Mr. SORTEBURG. I was thinking more in terms of how the utility addresses that in their encouraging of efficiency improvements. You know, they are the ones that people look to as the authorities on these issues.

Mr. HARKIN. Do you have a response to his question?

Mr. KOZYRSKI. I think a short response is that collectively, when we recommend the installation of insulation or provide loans for it under programs like our interest-free program, there are also specifications in which contractors have to follow for the insulation installation, and one of those things is proper ventilation. And I think you will find in most, if not all, the programs, those types of installations are subject to inspections. So that is one way we alleviate the vapor problem.

Now asphyxiation—I guess the gas people and oil people would have to address that question and I guess I don't have a good handle on how a customer would feel dizziness because he installed insulation in the home. I think the problems of combustion from oil and natural gas specifically are carbon monoxide and water vapor, the same thing that is exhaled when we breathe, a properly set up furnace should not—even if it is malfunctioning with its flue system—should not be dispensing any type of obnoxious odors in the house.

Mr. MOODY. I agree that there are problems. I don't want to address the weatherization much. I will talk about the air quality very briefly. I agree it is a problem, a potential problem. I don't know as we know enough about it. We have some studies started in cooperation with Harvard Medical School in looking at outdoor and indoor air quality problems associated with the new powerplant that we built. And we are going to step up that program to really look closely at homes before and we are going to weatherize some homes and look after the fact, and I think we have a lot to learn in these areas yet. And there may be some problems coming down the road we haven't addressed, but the need to weatherize is still there.

Mr. HARKIN. Do you have anything, Mr. Birdsall?

Mr. BIRDSALL. No, nothing.

Mr. HARKIN. Anything else before I switch the panel?

[No response.]

Mr. HARKIN. Going once, twice; thank you very much.

Our second panel concerns the housing area. Robert Burns, vice president, Midland Financial Savings & Loan, Des Moines; Tony Maggiore, Associate Director, Community Relations and Social Development Commission, Milwaukee, Wis.; and Clair Ames, Ames Building Company, Evansdale, Iowa.

Again, without objection, a copy of your entire testimony will be made a part of the record. Please proceed as you so desire.

One thing that you are probably now discovering about congressional hearings is that the first panel always takes a long time and then we have to hurry up because time is running out.

If you feel like you should read your testimony, fine; but if you can summarize it, I'd be most appreciative so we can get into some discussion.

First, I would like to call Mr. Robert Burns, vice president, Midland Financial Savings & Loan.

Mr. Burns, again, proceed as you so desire.

STATEMENT OF ROBERT BURNS, VICE PRESIDENT, MIDLAND FINANCIAL SAVINGS & LOAN, DES MOINES, IOWA

Mr. BURNS. Thank you.

I will compromise and read rather rapidly.

My name is Robert Burns and I'm vice president of residential mortgage lending for Midland Financial Savings & Loan Association of Des Moines, Iowa.

I have been a mortgage loan officer for 27 years; 14 years in southern California, 13 years at Midland Financial Savings, formerly known as Des Moines Savings, an association with assets in excess of $550 million.

A deep concern of Des Moines Savings for the growing crisis in our national energy situation particularly as it relates to housing became evident in 1977. The evening of April 6, 1977, following President Carter's first major energy address to the Nation, we were prepared to announce our new energy program to the public through the media.

Since that time, thanks to the foresight of the management of Des Moines Savings and the leadership of our president, Dick Bryan, we believe we have been directly responsible for contributing to reduce energy costs for over 4,000 homes in the Des Moines area.

In addition, it is hoped that we have influenced countless thousands of others to contribute a greater impact on energy conservation on their own homes through our educational efforts.

Our motives are not completely altruistic for we believe that a mortgagor who pays a smaller utility bill each month is a better credit risk. Second, that major investors on the secondary market and home buyers would increasingly recognize that an energy efficient house is a better investment than its counterpart. Third, that based upon the projection of energy experts, utility costs would one day soon rival mortgage payments. Apparently that day may be here sooner than we once thought.

Although we have been quite active in the construction of new homes, our loan volume and purchase of existing properties was and is considerably larger. Therefore we adopted the slogan of "Do

something; do it now," and concentrated our major efforts toward the retrofit of existing houses.

Here is what we offered to the general public and to our existing loan customers:

(1) Home improvement loans were offered up to $5,000 at 9 percent, which was about 3 percent under the 1977 market interest rate. Such low rates were only for loans to retrofit existing property for energy-conserving items such as insulation, weatherstripping, caulking, storm windows, energy efficient furnaces, solar panels, et cetera.

Mr. HARKIN. What were the terms; how many years?

Mr. BURNS. These were typical home improvement loans. I would surmise they were probably 10 to 15 years.

(2) Our second and even more drastic step was to inform our existing home loan customers that we would advance them up to $2,000 for energy items at their existing loan rates. For example, those who held a 6½ percent mortgage could borrow the additional funds for retrofits at 6½ percent, with no fees and payments amortized over the remaining life of the loan.

Mr. HARKIN. Are you still doing that?

Mr. BURNS. No, sir.

Mr. HARKIN. I was going to say——

Mr. BURNS. No, sir; no, sir. Unfortunately, we cannot afford to do it in today's money market, but we did for years.

Mr. HARKIN. Under (1), are you doing anything like that now at a reduced rate at all?

Mr. BURNS. No, sir. We are still doing No. 3, which I am coming to now.

The third step and perhaps even more bold was to insist that we finance in sale/purchase transactions only houses that were updated in energy conservation, updated as much as reasonably possible. For example, most existing homes we appraised had insufficient insulation in the attic, approximately an R-8 or an R-10, whereas the standard for our climate calls for R-30 to 33. We required that the quality be brought up to R-30, if possible, much as FHA requires a broken window to be replaced prior to closing a loan.

In addition, caulking and weatherstripping would have to be up to par, as well as attic ventilation, storm doors, storm windows and screens.

A sample of our appraisal energy inspection sheet is submitted with this testimony. We did make the requirements more acceptable by offering to add the improvement costs to the loan. Most customers appreciated our concern for their financial wellbeing and we thereby made more friends.

Hopefully, we believe by saving on energy costs, such dollar savings might be available for badly needed savings accounts. As we went into these programs, we found we had to be better educated in the energy field. First, we had to educate ourselves. Our desperate pleading for knowledge led to seminars and workshops by our U.S. League.

Actually, the very first seminar was held in Des Moines. Others were later held around the country. Many publications, books, brochures and pamphlets were discovered by us already in existence

and many more came on the scene during this time of energy awareness.

One such publication we discovered and used to great advantage is the "Home Energy Savers Manual," put out by the Iowa Energy Policy Council.

After a process of education of sorts, we acquired a measure of confidence that we knew a little more than the public, so our next step was to try to share our knowledge with the public. As a prime mover in this education in Des Moines and central Iowa, we secured the assistance of the local utility company, the State of Iowa Energy Council, and the Des Moines Public School System, to conduct open meetings in the school auditoriums during the evening hours.

The meetings were well advertised in local newspaper and radio. Through trial and error, we developed an excellent show and tell program of about 30 to 40 minutes of formal presentation with slides, followed by questions and answers in an audience participation session. We conducted 12 seminars and averaged about 60 people at each meeting.

We later turned the program over to the adult education division of the Des Moines Public School System. The first seminar at West Side High School had 5 attendees and there are over 100 people attending a modern dance class in a room next door.

Later we developed a substantial energy information center in our homeoffice and also many centers in 12 branches. This homeoffice energy center's focal point was a cutaway minihouse with special exhibit panels on insulation, weatherstripping, caulking, energy efficient hot water heaters, et cetera, as well as an information library.

Our lobby displays were supplemented from time to time with special exhibits such as Operation Sky-scan thermograms, air photos that clearly demonstrated heat loss through roofs. Curiosity drew large crowds for such displays.

As a part of the educational process, at the time of closing each of our residential loans, we reviewed the appraiser's energy report with each customer; then gave them each an energy kit, which included various literature on a wide range of energy subjects. We then placed in their hands a caulking compound and caulking gun with our encouragement for them to personally help make their personal dwellings more energy efficient.

We have enjoyed moments of success and triumph: witness the energy conservation award by the State of Iowa; the first award to a business in Iowa, and we have known the agony of defeat. Like the first session we held after extensive advertising and only five people showed up.

You might ask did our mortgage world of borrowers, sellers and realtors love us for our efforts in trying to help homeowners reduce their operating costs? A great many people appreciated our action, particularly the buyers who benefited by lower utility bills each month. But what about our realtor friends? It became a concern when we discovered they had mixed reaction toward our program.

Accepting the challenge, we then conducted a show and tell campaign at 150 realtor offices, explaining an energy efficient home and a mutual benefit to all involved. Many of the realtors in Des

Moines were concerned about the possible loss of a sale and the commission because of either buyer or seller refusing to pay for energy-related corrections. We believed and stated the realtors as well as lendors, have a long-range investment, not only in housing but in their present customers. A client who is fairly treated and does save on energy costs each month will prove to be a long-range customer who will likely return to that same realtor years later when the time comes to list his home for sale.

Thousands of realtors and customers in our market area by now have received a caulking gun and tube of compound, compliments of Des Moines Savings and Midland Financial.

The realtors' response has improved measurably since these office visits.

Continuing problems I want to talk about now. In the final portion, it might be well to briefly look at areas of continuing concern:

(1) Education still remains a top priority. The public becomes more amenable to educational input each month as they receive their utility bills, especially during these severe winter months. And this need will increase in direct proportion to each escalating utility bill.

(2) It is becoming more difficult under current high interest rates for people to borrow funds for energy conservation improvements, to get the funds and to be able to pay back the funds.

(3) Appraisal societies under the leadership of Freddy Mac and Fanny Mae need to approve appraisal processes and forms so there is uniformity in completing the appraisal form data. It will mean that appraisers carry a small aluminum ladder in order to inspect ceiling insulation. Then estimate the energy efficiency on the appraisal form and, finally, start building this data into their comp files.

(4) Realtors and lenders will have to sell energy conservation in a positive and equitable manner. If one lender enforces strict energy conservation requirements and his competitors do not, realtors will tend to take their customers on a course of least resistance. This, hopefully, can be offset by the secondary market buyer demanding loans secured by energy efficient homes.

Conclusion: Under the auspices of the U.S. League of Savings Association and other leaders in our business, we are continuing to push for more energy conservation in housing. Even now plans are underway for meetings to be held in late winter and early spring around the country by the various groups concerned with this program.

Thank you for the opportunity to testify. I will be glad to answer any questions from the staff or the public.

[The prepared statement of Mr. Burns follows:]

PREPARED STATEMENT OF ROBERT J. BURNS, VICE PRESIDENT, RESIDENTIAL MORTGAGE LENDING, MIDLAND FINANCIAL SAVINGS AND LOAN ASSOCIATION

My name is Robert Burns and I'm Vice President of Residential Mortgage Lending for Midland Financial Savings and Loan Association of Des Moines, Iowa. I have been a mortgage loan officer for 27 years - 14 years in Southern California and 13 years at Midland Financial Savings, formerly known as Des Moines Savings, an association with assets in excess of $550,000,000.

A. History of Energy Efforts by Des Moines Savings/Midland Financial

A deep concern at Des Moines Savings for the growing crisis in our national energy situation - particularly as it relates to housing - became evident in 1977. The evening of April 6, 1977, following President Carter's first major energy address to the nation, we were prepared to announce our new energy program to the public through the media. Since that time - thanks to the foresight of the management at Des Moines Savings and the leadership of our President Dick Bryan - we believe we have been directly responsible for contributing to reduced energy costs for over 4,000 homes in the Des Moines area. In addition, it is hoped that we have influenced countless thousands of others to contribute a greater impact on energy conservation on their own homes through our educational efforts. Our motives were not completely altruistic - for we believe that a mortgagor who pays a smaller utility bill each month is a better credit risk; second, that major investors on the secondary market and home buyers would increasingly recognize that an energy efficient house is a better investment than its counterpart; third, that based upon the projections of energy experts, utility costs would one day rival mortgage payments. Apparently that day may be here sooner than we once thought.

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Here's what we offered to the general public and to our existing loan customers:

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(2) Our second - and even a more drastic step - was to inform our existing home loan customers that we would advance them up to $2,000 for energy items at their existing loan rates. Example: those who held a 6½% mortgage could borrow the additional funds for retrofit at 6½% with no fees and payments amortized over the remaining life of the loan.

(3) The third step - and perhaps even more bold - was to insist that we finance in sale/purchase transactions only houses that were updated in energy conservation - updated as much as reasonably possible. For example, most existing homes we appraised had insufficient insulation in the attic - possibly an R-8 or R-10 whereas the standard for our climate calls for R-30 to R-33. We required that the quality be brought up to R-30 if possible - much as FHA requires a broken window to be replaced prior to closing a loan. In addition, caulking and weatherstripping would have to be up to par, as well as attic ventilation, storm doors, storm windows and screens. A sample of our Appraisal Energy Inspection Sheet is submitted with this testimony.

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As we went into these programs we found we had to become better educated in the energy field. First, we had to educate ourselves. Our desperate pleading for knowledge led to seminars and workshops by our U.S. League. Actually, the very first seminar was held in Des Moines - others were later held around the country. Many publications, books, brochures and pamphlets were discovered by us already in existance and many

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Later, we developed a substantial energy Information Center in our Home Office, and also mini-centers in 12 branches. This Home Office Energy Center's focal point was a cut-away mini-house with special exhibit panels on insulation, weatherstripping, caulking, energy efficient hot water heaters, etc. - as well as an information library. Our lobby displays were supplemented from time to time with special exhibits such as Operation Sky-Scan-Thermo-Grams - air photos that clearly demonstrated heat loss through roofs. Curiosity drew large crowds for such displays. As a part of the educational process, at the time of closing each of our residential loans, we reviewed the appraisers energy report with each customer then gave each an energy kit which included various literature on a wide range of energy subjects. We then placed in their hands a caulking compound and gun with our encouragement for them to personally help to make their personal dwellings more energy efficient.

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B. Continuing Problems

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(1) Education still remains a top priority. The public becomes more amenable to educational input each month as they receive their utility bills - especially during these severe winter months. And this need will increase in direct proportion to each escalating utility bill.

(2) It is becoming more difficult under current high interest rates for people to borrow funds for energy conservation improvements.

(3) Appraisal societies and the leadership of Freddy Mac (FHLMC) and Fanny Mae (FNMA) need to improve appraisal processes and forms so there is a uniformity in completing the appraisal form data. It will mean that appraisers carry a small aluminum ladder in order to inspect ceiling insulation, estimate the energy efficiency on the appraisal form and start building this data into their comp files.

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C. Conclusion

Under the auspices of the U.S. League of Savings Associations and other leaders in our business, we are continuing to push for more energy conservation in housing. Even now, plans are underway for meetings to be held in late winter and early spring around the country by the various groups concerned with such programs.

Thank you for the opportunity to testify. I shall be glad to answer any questions from subcommittee members and staff.

MIDLAND FINANCIAL
Savings and Loan Association

ENERGY EFFICIENCY ANALYSIS

Borrower _____ Date _____
Property Address _____
Style: split-level _____ ranch _____ two-story _____ Other _____
Size: Square feet _____ New home _____ Existing _____
Furnace uses: Heat pump _____ natural gas _____ LP gas _____ Electric _____
Cooling system: Heat pump _____ central air _____ window unit _____ none _____
Utility bills: (excluding water)
Average monthly amount: Actual $_____ Estimated $__ _____

THERMAL INSULATION GUIDELINES:
Insulation should be upgraded to recommended R-values.

	Thickness	Material	Estimated R-Value	Recommended R-Value	Est. Improvement Cost
Ceilings	_____	_____	_____	_____	$_____
Walls	_____	_____	_____	_____	$_____
Basement	_____	_____	_____	_____	$_____
Other (_____)	_____	_____	_____	_____	$_____

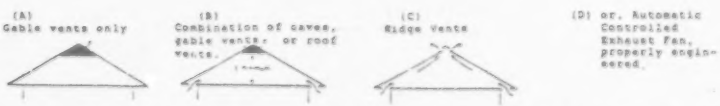
Comments: _____

WINDOWS & DOORS GUIDELINES
Should be thermopane/storm units/total frame in good condition.

	Windows	Doors	Storms	Est. Improv.Cost
Caulking	_____	_____	_____	$_____
Weatherstripping	_____	_____	_____	$_____
General Condition	_____	_____	_____	$_____

Comments: _____

ATTIC VENTILATION GUIDELINES - Should meet following:



1 sq. ft. inlet and 1 sq. ft. outlet for each 300 sq. ft of ceiling area (600 sq. ft. w/vapor barrier), with at least half of the vent area at the top of the gables and the balance at the eaves.

Gable Vents - No.____ Size____ Total Free Area____
Roof Vents - No.____ Size____ Total Free Area____
Soffit Vents- No.____ Size____ Total Free Area____
TOTAL ____

Amount of Free Area Required: ____

☐ Adequate; ☐ Not Adequate; ☐ Adequate w/Improvement: Est. Improv. Cost $_____

Comments: _____

EST. TOTAL IMPROV. COST $_____

NOTE TO APPLICANT: Midland Financial is concerned about the energy efficiency of the homes on which we make long-term mortgage loans. The above information is our analysis of the subject property and how we evaluate it from an energy-efficiency standpoint. WE WOULD STRONGLY SUGGEST YOU GET SEVERAL ESTIMATES ON ANY WORK YOU MAY HAVE DONE. We also trust that the information is of interest, and helpful to you.

Perhaps there are additional areas of your home which should be explored to make it truly energy efficient. Here is an idea-starter check list. Detailed information on most of these subjects can be found in our "Energy Conservation Kit".

Fireplace - (damper integrity)
Insulation of pipes and ducts
Solar assistance - (properly engineered)
House exhaust fan - (properly engineered)
Unused rooms - (close them off)
Thermostat setting - (automatic)
Lighting, TV, appliances - (use as needed)
Shading/Windbreaks - (trees, awnings, etc.)
Furnace/airconditioning - (regular servicing)
Appliances - (energy efficient purchase/use)
Drapes - (closed or open)
Basement - (windows and walls)

Mr. HARKIN.Very good. Thank you very much. I will just comment, and I will talk about it later, that if all the banks and savings and loans in the country were doing what you are talking about, even in that third step——

Mr. BURNS. It would make a big difference, wouldn't it?

Mr. HARKIN. Oh, boy, would that make a difference.

Mr. BURNS. Big difference, and it is not that difficult a deal. We found that typically it cost three, four, five hundred dollars to take care of the insulation, weatherstripping and caulking, and that was not a big deal, really.

Mr. HARKIN. Just build it right into——

Mr. BURNS. Build it right into it. If they buy a house for $40,000, and they make it a little bit more weathertight, that envelope, the house should be worth $40,500, $41,000. It cost a few hundred dollars to do it. Some of the work they can do themselves quite easily, caulking and weatherstripping. It is not a big deal.

Mr. HARKIN. I will get back to that a little later.

Second, Mr. Maggiore, Associate Director, Community Relations and Social Development Commission in Milwaukee, Wis. And I do have a copy of your testimony, too, and without objection it will be made part of the record.

Please proceed.

STATEMENT OF ANTHONY J. MAGGIORE, JR., ASSOCIATE DIRECTOR, COMMUNITY RELATIONS/SOCIAL DEVELOPMENT COMMISSION, MILWAUKEE, WIS.

Mr. MAGGIORE. I am the associate director for the community relations/social development commission, a public intergovernmental social planning and community action agency in Milwaukee County.

I am a member of the board of directors of the National Center for Appropriate Technology, a program that has funded several solar and community energy planning projects in Iowa.

Recently, I was also a member of the Fuel Oil Marketing Advisory Committee of the U.S. Department of Energy, and served as chairperson of a committee which published reports on low-income energy assistance programs in 1979 and 1980. A copy of the latest report, submitted July 1980, and titled "Low Income Energy Assistance Program," Profile of Need and Policy Options" is submitted to the committee for the record.

I want to thank you for the opportunity to testify before your committee on low-income households and the energy conservation programs.

The major issues confronting all energy consumers today are partially the result of a governmental policy which promotes increased costs for energy in order to promote needed conservation and increased domestic production.

In my opinion, another policy is essential, a policy which relieves low-income and the elderly of the immediate and intolerable burdens imposed by this policy of increased costs. Without such policy, the health and safety and even the lives of low-income persons and especially the elderly, will be jeopardized.

During this testimony, I will attempt to outline the impact of rising energy costs on low-income households, the benefits from weatherization and other energy conservation programs, highlights of some energy programs in the Midwest and my recommendations to the committee.

The report I referred to earlier published last year by the Fuel Oil Marketing Advisory Committee for the Department of Energy finds that overall, the poor will expend at least 35 percent of their income directly on energy and will spend at least 21 percent of their income on household energy, and that is a national figure. So in the Midwest and the North, the figure would rise substantially.

Low Income households will still continue to pay nearly four times more the percentage of their incomes on household energy than the average American household. They have suffered a loss in average total income in real terms since 1972, making the acquisition of adequate energy for this group even more difficult; have lost over $6 billion in purchasing power in 1980, alone, due to increases in energy costs; have experienced in certain regions of the country a particularly harsh and disproportionate burden in paying for energy.

They have less ability to offset increased energy costs through product substitution in the marketplace than for any other necessity used by poor households. They use less than 50 percent of the total energy consumed by the average American household and 25 percent less household energy. And they continue by necessity to occupy low quality energy-inefficient housing stock that further penalizes them in their effort to cut energy costs. They also lack the financial resources to implement significant additional conservation improvements.

A report released by the Department of Energy indicated that the average U.S. household spends somewhat over 4 percent, less than 5 percent, of its before-tax-income for residential and home energy in the heating season of 1977–80. This data is consistent with the study referred to above as well as the recent report of the 1980–81 low-income energy assistance program for the Great Lakes region and regions I, II, IV, and VIII, issued by the U.S. Department of Health and Social Services which stated that the low-income households sampled would have spent 29 percent of their monthly income during the winter for fuel if they did not receive any financial assistance.

In addition, a recently released study by the National Council of Senior Citizens and the National Council of Churches indicates that in the State of Iowa, a $101 million subsidy to low-income households would be necessary if a goal was to keep the annual income proportion of household expenditures for energy the same as the average household in Iowa. If a goal was to double the annual income proportion of household expenditures for the poor relative to energy in comparison to the average household, $68 million would be necessary.

It is my understanding neither figure is what the energy assistance funding level for Iowa is this year. It is substantially less than that.

As energy prices continue to rise, the need for conservation becomes even more acute. A number of basic realities must be ac-

knowledged if a long-term solution to the energy needs of the poor is to be found.

The residential structures of low-income people tend to be in poorer condition and less energy efficient than those of higher income families. As a recent national housing survey shows, basic energy conservation features are more likely to be absent in the housing of the poor and near poor.

This lack of energy efficiency results in annual fuel bills substantially higher than they should be. In terms of simple conservation measures such as thermostat setbacks, caulking and weatherstripping, the poor have already conserved as much as possible. Yet, they lack the necessary funds to invest in additional conservation such as weatherization and use of alternative energy sources which would result in greater energy savings.

A recent DOE survey of conservation behavior shows that the poor are just as likely as average-income households to take cost-free conservation measures, such as shutting off rooms, and so forth.

However, as the cost of conservation measures increase, such as adding insulation, the poor are less likely than the average household to implement such measures. And the charts attached demonstrate those findings.

The Federal weatherization program has been in existence since 1973. The program was developed and administered by the Community Services Administration in response to the impact of OPEC price increases on low-income households. Through congressional action, the program was transferred to the U.S. Department of Energy in 1977. Under the DOE program, grants are made to States which generally subcontract to community action agencies to serve as local delivery mechanisms. Most geographic areas of the country are presently served by the program.

Though the DOE program initially had serious management and coordination problems, during the past year, the program has improved significantly. For example, during calendar year 1979, the program weatherized 144,000 housing units throughout the country. During calendar year 1980, the program weatherized over 311,000 housing units, an increase of over 100 percent. Recent studies of the DOE weatherization programs in Indiana, Michigan, Minnesota, Pennsylvania, Utah, Washington, and Wisconsin, indicated an average household savings of 20 to 25 percent. Since current data indicates that low-income households on the average spend at least 21 percent of their income on household energy—in the Midwest and Northeast parts of the country, it is over 30 percent—the projected 20–25 percent energy conservation saving is necessary for the household to have sufficient finances to purchase food, shelter, clothing, et cetera.

The current national funding level for the weatherization program is $144 million, a sum inadequate to weatherize even a small number of low-income homes nationwide.

Today, according to the U.S. Census Bureau, there are approximately 15 million low-income households at 125 percent of poverty. That figure, by the way, is probably substantially higher since it is at least 18 months old. So I would argue there are probably about

18 to 20 million low-income households today as compared to 18 months ago, as a result of the economy.

Since 1973, when the national weatherization efforts began, approximately 1 million homes have been weatherized. At the current level of funding, it would take beyond the year 2000 to weatherize most low-income homes.

The national weatherization program serves eligible low-income households with a priority placed on the elderly and handicapped. The recent success of the program has documented clearly the effectiveness of the program and the financial relief provided to the households receiving services.

Relative to other energy conservation programs, the administration's proposal stated in the document titled, "A Program for Economic Recovery," dated February 18, 1981:

> By placing greater emphasis on the private sector in developing and marketing solar products, DOE solar spending can be reduced by more than 60 percent in 1981.
>
> The reduction of energy conservation programs are proposed for the three types of conservation programs conducted by the Department of Energy: technology development, regulation and information, financial assistance to the State and local governments.
>
> Regulatory programs mandating building and appliance efficiency standards and utility conservation services have small Federal costs, but if undertaken as planned by the previous administration, they would impose massive regulatory burdens on the private sector. Therefore these programs would also be eliminated.

A recently released survey of school districts participating in the U.S. Energy Department energy conservation program indicates that the program has had an average payback of 4.8 years, and has reduced energy consumption an average of 20.7 percent. This survey concludes that the program yields almost $4 for every $1 of Federal money invested in the conservation grant.

The survey was conducted by the American Association of School Administrators under a grant from the U.S. Department of Energy. The overall program provides 50 percent matching grants for energy audits and conservation retrofit measures in schools, hospitals, and some public buildings. The administration has proposed to eliminate this program.

There are many other similar results from projects in the area of solar, appropriate technology, alcohol fuel, and consumer education, all of which have been substantially reduced or eliminated by the administration.

The administration appears to assume that market forces alone will induce conservation. This question is at what cost in local taxes and human suffering? After how much energy has been wasted and with what impact on national security? If there is reason for Federal intervention in any energy sector to protect individuals, communities, and the Nation as a whole, it is conservation.

Some brief highlights of energy conservation projects in the Midwest: Many consumer education projects in the Midwest tend to be low-cost and labor-intensive with utilization of renewable energy. Examples range from active and passive solar heating projects to local community energy planning and management projects.

In West Des Moines, Iowa, for example, the National Center for Appropriate Technology has funded an energy management proj-

ect, in other parts of the State, solar greenhouses, and energy education radio presentations.

In Illinois, solar water heating and integrated food and energy small farm projects have been funded by the Department of Energy, National Center for Appropriate Technology, and the Community Services Administration.

In Minnesota, active solar energy projects, energy consumer education programs, and alcohol fuel demonstrations have been implemented during the past 3 years.

The list of low- and high-cost technical projects in the Midwest is substantial. As a result of Federal financing reductions, many worthwhile programs have been eliminated.

Non-Federal funding of many of these similar kinds of programs have also been reduced.

Recommendations to the committee:

(1) To continue and if necessary reestablish the U.S. Department of Energy conservation programs funded in 1981, at that year fiscal funding level.

(2) To promote and legislate a comprehensive system of services to assist low-income households in coping with the increased cost of energy, including but not limited to a national weatherization program, fuel assistance program, energy education conservation program, utilization of appropriate and alternative technologies.

(3) Increase the current appropriation of $144 million to $400 million for fiscal year 1983, for the national weatherization program.

As this recommendation relates to low-income weatherization and consumer education programs, it appears that Congress has two choices: Fund the low-income weatherization program at a realistic level, in order to conserve energy, relieve the energy fiscal burden on low-income and elderly households and reduce future costs of the federally sponsored fuel assistance program; or, continue because of political and practical necessities to annually increase fuel assistance funding to protect the health and safety of low-income households and the elderly.

(4) An increased versus decreased Government role is needed in the implementation of national energy policy. The average citizen, especially low-income people, cannot possibly compete with the power and influence of the business community in Washington, D.C., State capitals or local municipalities. Low-income people and the average middle-class citizen need the strong role of the Federal Government to protect their interest.

Conservation through price increases is not possible for low-income people since their incomes cannot tolerate the burden of rising energy costs.

Thank you.

[The prepared statement of Mr. Maggiore follows:]

PREPARED STATEMENT OF ANTHONY J. MAGGIORE, JR., ASSOCIATE DIRECTOR, COMMUNITY RELATIONS-SOCIAL DEVELOPMENT COMMISSION IN MILWAUKEE COUNTY

Mr. Chairman, my name is Anthony J. Maggiore, Jr. I am the Associate Director for the Community Relations-Social Development Commission - a public intergovernmental social planning and Community Action Agency in Milwaukee County. I am a member of the Board of Directors of the National Center for Appropriate Technology - a program that has funded several solar and community energy planning projects in Iowa. Until recently, I was also a member of the Fuel Oil Marketing Advisory Committee of the U. S. Department of Energy and served as Chairperson of a committee which published reports on Low Income Energy Assistance Programs in 1979 and 1980. A copy of the latest report dated July, 1980 and title "Low Income Energy Assistance Programs - A Profile of Need and Policy Options" is submitted to the committee for the record.

I want to thank you for the opportunity to testify before your committee on Low Income Households and the Energy Conservation Programs.

The major issues confronting all energy consumers today are partially the result of a government policy which promotes increased costs for energy in order to promote needed conservation and increased domestic production.

In my opinion, another policy is essential, a policy which relieves low income and elderly of the immediate and intolerable burdens imposed by this policy of increased costs. Without such a policy, the health and safety--even the lives--of low income persons, and especially the elderly will be jeopardized.

During this testimony, I will attempt to outline the impact of rising energy costs on low income households, the benefits from weatherization and other energy conservation programs, highlights of some energy programs in the Midwest, and my recommendation to the committee.

I. IMPACT OF RISING ENERGY PRICES ON LOW INCOME HOUSEHOLDS

A report published in July, 1980 by the Fuel Oil Marketing Advisory Committee (FOMAC) of the U.S.Department of Energy finds that, overall the poor:

1. will expend at least 35% of their income directly on energy and will spend at least 21% of their income on household energy;
2. will still continue to pay nearly 4 times more the percentage of their income on household energy than the average American household;
3. suffered a loss in average total income in real terms since 1972, making the acquisition of adequate energy for this group more difficult;
4. will lose over $6 billion in purchasing power in 1980 due to increases in energy costs;
5. have experienced, in certain regions of the country, a particularly harsh and disproportionate burden in paying for energy;
6. have less ability to offset increased energy costs through product substitution in the marketplace than for any other necessity utilized by poor households;
7. will use less than 50% of the total energy consumed by the average American household and 25% less household energy;
8. will continue, by necessity, to occupy low quality, energy inefficient housing stock that further penalizes them in their effort to cut energy costs; and,
9. lack financial resources to implement significant additional conservation improvements.

A report released by the U. S. Department of Energy indicated that the average U.S. Household spend somewhat over 4% of its before-tax income for residential (in-home) energy in the heating season of 1977-80.[1]

This data is consistent with the FOMAC study as well as a recent report of the 1980-81 Low Income Energy Assistance Program for the Great Lakes Region and Regions I,II,IV & VIII issued by the U.S.Department of Health & Human Services which stated that the low income households sampled would have spent 29% of their monthly income during the winter for fuel, if they did not receive any financial assistance.[2] In addition, a recently released

study by the National Council of Senior Citizens and the National Council of churches indicates that in the State of Iowa - a $101 Million dollar subsidy to low income households would be necessary if a goal was to keep the annual income proportion of household expenditures for energy the same as the average household in Iowa. If a goal was to double the annual income proportion of household expenditures for energy in comparison to the average household, $68 million dollars would be necessary.[3]

[1] U.S. Department of Energy, Energy Information Administration, Residential Energy Consumption Survey's 1979-80 Consumption and Expenditures, Part I, April 1981.

[2] U.S.Department of Health & Human Services, Office of the Inspector General, Low Income Energy Assistance Program, A Service Delivery Assessment, September 11, 1981.

[3] National Council of Senior Citizens and the National Council of Churches, The Cost of Survival, subsidies required to help Elderly and Low Income Americans Meet Home Energy Bills. Grier Partnership, October, 1981.

II. BENEFITS FROM WEATHERIZATION

As energy prices continue to rise, the need for conservation becomes even more acute. A number of basic realities must be acknowledged if a long term solution to the energy needs of the poor is to be found:

1. The residential structures of low income people tend to be in poorer condition and less energy efficient than those of higher income families. As a recent national housing survey shows, basic energy conserving features are more likely to be absent in the housing of the poor and near poor (See Table I).

2. This lack of energy efficiency results in annual fuel bills substantially higher than they should be.

3. In terms of simple conservation measures such as thermostat set-backs, caulking, and weatherstripping, the poor have already conserved as much as possible. Yet, they lack the necessary funds to invest in additional conservation such as weatherization and use of alternative energy sources which would result in greater energy savings. A recent DOE survey of conservation behavior shows that the poor are just as likely as average income households to take cost-free conservation measures (such as shutting off rooms; see Table II). However, as the cost of conservation measures increase (such as adding insulation) the poor are less likely than average income households to implement such measures.

TABLE I

EXISTING ENERGY-RELATED CHARACTERISTICS BY 1977 FAMILY INCOME 1/
(Winter 1978-79)

	1977 FAMILY INCOME					
	Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 or More
TOTAL	100%	100%	100%	100%	100%	100%
STORM WINDOWS						
All windows covered	30	34	39	48	43	48
Some windows covered	19	20	19	18	25	22
No windows covered	52	46	43	34	32	30
STORM DOORS						
All doors covered	30	38	36	41	39	37
Some doors covered	18	22	21	25	25	31
No doors covered	52	41	42	34	34	31
ATTIC INSULATION						
Have insulation	41	57	69	74	80	86
No insulation	37	29	19	15	9	9
Don't know	22	13	14	11	11	5
HAVE WALL INSULATION						
Yes	28	41	51	56	57	63
No	44	34	25	25	23	18
Don't know	27	24	24	19	20	19

1/ Source: U.S. Department of Energy, Residential Energy Consumption Survey: Conservation, Washington, D.C., Feb. 1980, p. 31.

TABLE II

CONSERVATION EFFORTS UNDERTAKEN IN 1978 BY 1977 FAMILY INCOME 1/
(Percentage of Households)

	1977 FAMILY INCOME					
	Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 or More
Type of Conservation Measure:						
ROOMS CLOSED OFF						
Yes	28	33	31	31	32	30
No	59	55	56	61	57	60
No answer	13	12	13	8	11	10
ADDED INEXPENSIVE INSULATION						
Yes	18	23	26	32	31	27
No	82	77	74	68	69	73
ADDED INEXPENSIVE EQUIPMENT						
Yes	4	4	7	8	11	12
No	96	96	93	92	89	88
ADDED EXPENSIVE INSULATION						
Yes	3	3	6	6	8	9
No	97	97	94	94	92	91
ADDED EXPENSIVE EQUIPMENT						
Yes	3	3	5	5	7	8
No	97	97	95	95	93	92

1/ Source: U.S. Department of Energy, Residential Energy Consumption Survey: Conservation, Washington, D.C., Feb. 1980, pp. 31, 115.

The Federal Weatherization Program has been in existence since 1973. The program was developed and administered by the Community Services Administration in response to the impact of OPEC price increases on low income households. Through Congressional Action, the program was transferred to the U. S. Department of Energy (DOE) in 1977. Under the DOE program, grants are made to states which generally subcontract to Community Action Agencies to serve as local delivery mechanism. Most geographic areas of the county are presently being served by the program.

Though the DOE weatherization program initially had seious management and coordination problems, during the past year, the program has improved significantly. For example, during calendar year 1979 the DOE program weatherized 144,000 housing units throughout the county. During calendar year 1980, the DOE program has weatherized over 311,000 housing units - an increase of over 100%.

Recent studies of DOE weatherization programs in Indiana, Michigan, Minnesota, Pennsylvania, Utah, Washington and Wisconsin indicated an annual household energy saving of 20-25%. Since current data indicates that low income households on the average, spend at least 21% of their income on household energy (in the Midwest and Northeast region of the U. S. it is over 30%), the projected 20-25% energy conservation saving is necessary for the household to have sufficient finances to purchase food, shelter, clothing, etc.

The current national funding level for the weatherization program is $144 million dollars - a sum inadequate to weatherize even a small number of low income homes. Today, according to the U. S. Census Bureau, there are approximately 15 million low income households at 125% of poverty. Since

1973 when national weatherization efforts began, approximately 1 million homes have been weatherized. At the current level of funding, it would take beyond the year 2000 to weatherize most low income homes.

The national weatherization program serves eligible low income households with a priority placed on the Elderly and Handicapped. The recent success of the program has documented clearly the effectiveness of the program and the financial relief provided to the household's receiving services.

III. OTHER ENERGY CONSERVATION

The Administration's proposal stated in the document titled "A Program For Economic Recovery" dated February 18, 1981, states:

"By placing greater emphasis on the private sector in developing and marketing solar products, Department of Energy solar spending can be reduced by more than 60% in 1981".

"Reduction of Energy Conservation Programs --- Program reductions are proposed for the three types of conservation programs conducted by the Department of Energy: technology development, regulation and information, financial assistance to the State and Local governments".

"Regulatory programs mandating building and appliance efficiency standards and utility conservation services have small Federal costs, but if undertaken as planned by the previous administration, they would impose massive regulatory burdens on the private sector. -- Therefore, these programs would also be eliminated".

A recently released survey of school districts participating in the U.S. Energy Department energy conservation program indicates that the program has had an average payback of 4.8 years and has reduced energy consumption an average of 20.7%. The survey concludes that the program yields almost $4 for every $1 of federal money invested in the conservation grant. The survey was conducted by the American Association of School Administrators under a grant from the U.S. Department of Energy. The overall program provides 50% matching grants for energy audits and conservation retrofit measures in schools, hospitals, and some public health buildings.

There are many other similar results from projects in the area of solar, appropriate technology, alcoholism fuels, consumer education, etc., - all of which have been substantially reduced or eliminated by the Administration.

The Administration appears to assume that market forces alone will induce conservation. The question is, at what cost in local taxes and human suffering? After how much energy has been wasted? And with what impact on National Security? If there is a reason for Federal intervention in any energy sector to protect individuals, communities, and that Nation as a whole --- it is conservation.

IV. BRIEF HIGHLIGHTS OF SOME ENERGY CONSERVATION PROJECTS IN THE MIDWEST

Many consumer education energy projects in the Midwest tend to be low cost and labor intensive with utilization of renewable energy. Examples range from active and passive solar heating projects to local community energy planning and management projects. In West Des Moines, Iowa the National Center for Appropriate Technology has funded an energy management project and in other parts of the state, solar greenhouses and energy education radio presentations.

In Illinois, solar water heating and integrated food and energy small farm projects have been funded by the U.S. Department of Energy, National Center for Appropriate Technology, and the Community Services Administration. In Minnesota, active solar energy programs, energy consumer education projects and alcoholism fuel demonstrations have been implemented during the past three years.

The list of low and high cost technical projects in the Midwest is substantial. As a result of Federal financing reductions, many worthwhile programs have been eliminated.

Non-Federal funding of many consumer energy conservation programs has also been reduced.

V. RECOMMENDATIONS

A. Continue and if necessary reestablish the U.S. Department of Energy Conservation programs funded in 1981, and at that fiscal year funding level.

B. Promote and legislate a comprehensive system of service to assist low income households in coping with the increased cost of energy, including but not limited to a national weatherization program, fuel assistance program, energy education conservation program, utilization of appropriate and alternative technologies, etc.

C. Increase the current appropriation of $144 Million to $400 Million for fiscal year 83 for the National Weatherization Program.

D. As this recommendation relates to low income weatherization and consumer education programs, it appears that Congress has two choices:

1. Fund the Low Income Weatherization Program at a realistic level, in order to conserve energy, relieve the energy fiscal burden on low income and elderly households, and reduce future costs of the Federally sponsored fuel assistance program

or

2. Continue because of political and practical necessities, to annually increase fuel assistance funding to protect the health and safety of low income households and the Elderly.

E. An increased versus decreased government role is needed in the implementation of National energy policy. The average citizen, especially low income people, cannot possibly compete with the power and influence of the business community in Washington, D.C., state capitals, or local municipalities. Low income people and the average middle class citizen need the strong role of government to protect their interest.

Conservation through price increases is not possible for low income people since their incomes cannot tolerate the burden of rising energy costs.

Thank you.

COMMUNITY RELATIONS-SOCIAL DEVELOPMENT COMMISSION

STAFF VITA

STAFF MEMBER:

ANTHONY J. MAGGIORE, JR.
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BIRTH:

2-22-36, Milwaukee, WI

FAMILY:

Married, 3 Children

ACADEMIC DEGREES, DATES, SCHOOLS

M.S.W. — 1963 School of Social Service, St. Louis University, St. Louis, Missouri

B.S. — 1960 University of Wisconsin-Milw., Milwaukee, Wisconsin

PRESENT EMPLOYMENT — DATES

Associate Director, Community Action Programs, Community Relations-Social Development Commission — February 16, 1969 to present

PAST EMPLOYMENT

Project Administrator, Inner City Development Project, Milwaukee, Wisconsin (Administration & Advocacy Planning & Organizing with Residents) — February 1967 to February 1969

Director, Southside Center, Inner City Development Project, Milwaukee, Wisconsin (Administration, & Advocacy Planning and organizing with residents) — June 1965 to February 1967

Liaison Caseworker, Catholic Social Services, Milwaukee, Wisconsin (Administration, Supervision and Casework) — June 1963 to May 1965

Other work experience has included psychiatric social work, probation and parole, group work, neighborhood street work, and community organization.

SOME MAJOR CONSULTATION AND TEACHING ACTIVITIES

1. Milwaukee Urban League, Milwaukee, Wisconsin
2. University of Wisconsin-Milwaukee School of Social Welfare, Department of Urban Affairs, and Department of Sociology. (Currently, Part time Instructor UW-M Graduate School: Department of Urban Affairs

SOME MAJOR CONSULTATION & TEACHING ACTIVITIES

3. Wisconsin State University-Oshkosh, WI
Department of Education
Special Training Project for Teachers
of Disadvantaged Children

4. Catholic Social Services
Milwaukee, Wisconsin

5. Milwaukee Boy's Club
Milwaukee, Wisconsin

6. State of Wisconsin, Divisions on Aging
Health and Social Services, Labor
and Industry, and Urban Affairs

7. Various Welfare Rights, Tenant's Rights,
Health Rights, Community Schools, Resident
Organizations functioning locally

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS, LOCAL,
AND STATEWIDE COMMITTEES, ETC.: Pertinent Examples:

1. National Association of Social Workers
1961 to present: Held various offices

2. Statewide Planning Committee for Vocational Rehabilitation
Services-for the Economically Disadvantaged

Madison, Wisconsin
1966-71 - Member

3. Wisconsin Welfare Counsil

Madison, Wisconsin
1969 to present

4. Chairman-National Intergovernmental Task Force on Victimization of Senior
Citizens 1975 to 1977

5. Chairman-National Committee on Crime and the Elderly - 1976 to present

6. Member State of Wisconsin Committee on Utilities Payments for Low Income People
June 1975 to 1977

7. Chairman-Youth Employment Advisory Committee-Milwaukee County Manpower Planning
Council 1977 to present

8. Member-Planning Committee to design National Programs for the Elderly -
Community Services Administration 1977 - 1978

9. Member-Fuel Oil Marketing Advisory Committee, U. S. Department of Energy,
Chairperson, FOMAC Subcommittee on Energy Assistance Programs
1978 to 1981

Mr. HARKIN. Thank you, very much, Mr. Maggiore, for excellent testimony, but also one that ought to be very disturbing to all of us. I hope that the members of the press who are still here pay special attention to the testimony that Mr. Maggiore has just given us.

I have some questions and I want to get into that a little bit more. I think about what is happening to those of us who make a decent income, and we know how we are screaming about our increased bills, multiply that tenfold for what is happening to poor people in this country to see how they are suffering. We will get into that in a little bit.

Our next witness is Clair Ames, Ames Building Corp., from Evansdale, Iowa.

Mr. Ames, again without objection, your testimony will be made a part of the record in its entirety. Please proceed as you so desire.

STATEMENT OF CLAIR AMES, AMES BUILDING CORP., EVANSDALE, IOWA

Mr. AMES. Thank you, Mr. Harkin.

The United States and Iowa share a common problem and that is both need to import a substantial amount of their energy. There is no single solution to this problem and no one person or firm can possibly come up with all the answers for all the questions. My personal contribution to this cause is in the residential and light commercial industry.

I must admit that I am not entirely motivated by the energy savings factor, alone, but I also have personal gain in mind. The knowledge I have gained from designing and building these energy-saving passive solar homes will make me the largest homebuilder in the Waterloo area within the next 2 years.

I am in the process of setting up to start manufacturing passive solar homes in a factory where they will be shipped to the jobsite for assembly. This operation is scheduled to start on March 1, 1982.

I started working in the construction field 13 years ago, and started my own business 6 years ago. We have built conventional well-insulated homes for several years and I always tried to stay one step ahead of the competition by coming up with new ideas.

I was one of the first in the area to start using 6-inch exterior walls, putting 10 inches of insulation in the attic instead of the normal 6, installing casement windows in all of our homes, which reduces infiltration into the home.

I also was one of the first to start using triple glazed windows. After doing all this I realized that there was only so much you could do with insulation and that there needed to be another answer to heating the homes with projected increases in the costs of natural gas, fuel oil, electricity, and the eventual depletion of firewood.

This was when I started looking into solar as a viable alternative. I spent quite a bit of time researching active solar heating which has fans, blowers, and a dozen other things that can go wrong with the system. I came to the conclusion that active solar was not the answer for new construction.

Then I started learning about what other people were doing with passive solar. This type of solar really made sense to me. Instead of

having a unit that you attach to conventional home, you designed the home to be the collector and the storage for the heat collection during the day.

Double glazed patio door glass was the obvious way to go with the south wall collector. It was inexpensive and readily available.

I researched the different types of heat storage mediums available: rock bed storage, eutectic salts, water, brick, and concrete. I came to the conclusion that the water storage system would be the best but the market did not offer anything commercially feasible to contain the water. So I decided to use concrete for the heat storage.

Concrete is generally used in the construction of a home, so it was logical that concrete could be installed in such a way that it could be used for the heat storage.

My first design was a two-bedroom ranch with a full basement. It was a direct gain design, which means that the sun is allowed to shine directly into the home with the concrete storage located in the interior. In this case, there was a concrete floor between the basement and the upper level, like it used in commercial buildings.

I had read that any passive solar home located north of Kansas City must use insulation over the south windows at night or you would lose more heat at night than you gained during the day. To solve this problem, I devised a night time insulation device which consisted of insulated garage doors which came down over the glass at night to reduce heat loss.

I learned after the first heating season when we didn't use the garage doors that the night insulation on the south windows was not all that critical, as it only costs $47.04 to provide the backup heat for this home with natural gas for the whole winter.

Mr. HARKIN. What did the door cost?

Mr. AMES. It was around $2,500.

Mr. HARKIN. Long payback period.

Mr. AMES. Right. No payback period, in fact, the next three homes that we built were also direct gain designs but without the night time insulation. The third home that I built was for my family. We moved into it September 26, 1980. This home was a two-level design with a direct gain on the upper level, using a concrete floor for storage, the same as the first solar home we built.

The lower level uses a concrete trombe wall. A trombe wall is a masonry south-facing wall that collects and releases stored heat into a building by both radiant and convective means. This wall is insulated from the exterior by double glazed glass.

I installed thermometers at various locations in our home to monitor the temperature fluctuations. The thermometers were read and recorded daily along with the outdoor temperatures. By spring, I had collected enough data on the home to come to the conclusion that the trombe wall design used on the lower level performed better than the direct gain on the upper level. Both upper and lower levels had an average temperature of 71 degrees, but the direct gain design had a much larger temperature fluctuation than the trombe wall design. The cost for heating my 1,700-square-foot home that winter was $58.86 with natural gas as the only backup heat.

With potential clients preferring ranch homes, in November of 1980, I designed a ranch style home using a combination direct

gain and concrete trombe wall. I designed just enough direct gain so that the structure would not overheat without any additional interior mass other than what would normally be found in a conventional home.

After consulting with Phil Svanoe and Rich Mercer of the Iowa Energy Policy Council, I was able to finalize the design. This design had a great market appeal. It only added about 10 percent to the cost of a standard home and by the end of 1981, we had built 11 homes with this type of design for a total sales volume of $867,000. Considering what the economy was doing and with interest rates hovering around 15 to 18 percent, that wasn't too bad.

With the number of sales achieved in 1981, with projected sales in 1982, it required that I redesign these popular passive solar homes so that they can be manufactured for mass production. The concrete trombe wall had to be replaced with heat storage material that could be transported from the factory to the job site.

There again, the most logical solution was to go with the water storage system. Water is always available at the job site and it is inexpensive. But I still had the problem of the availability of a commercial unit that could be purchased at a reasonable price. That is when I decided that I was going to have to design and build my own units.

After researching several commercially available products to build the water trombe units, I discovered what I needed was available in my old home town of Oelwein and they are a 10-inch ABS plastic nonperforated drain tile. When filled with water, capped and stood on end, they become ideal heat storage units. These units are then placed within 4 inches of the south-facing glass on the interior; one-half inch drywall is placed directly against the water trombe units to give the interior the look of a conventional wall.

The sun rays penetrated the glass and the heat is absorbed by the water trombe unit. The heat is then naturally radiated through the drywall, to the interior of the home.

The solar portion of the home is not the total secret to building a home that will perform as well as our homes do.

It starts with getting a complete understanding of how the cold from the outside gets into your warm home to begin with. A home must be built as airtight as possible. The best way to visualize this is to think of your home as a submarine and if it were to be submerged in water, where would it leak? Then caulk these areas with silicone caulk to seal the leaks.

The primary thing for the submarine is the entryway. We don't enter the submarine directly from the outside or the submarine would sink. The same is true for a home. You don't enter it directly from the outside you lose all the air which is heated by your furnace or the sun.

An airlock entry is used to prevent this. I also design all of our homes with 10-inch exterior walls on the north, east and west sides of the home. These are then insulated with fiberglass bat insulation to achieve an R-value of 35. The attics are then insulated to an R-value of 60.

To control the quality of the air in the home and to control humidity, we install air-to-air heat exchangers which reduce the heat load by recovering heat from the air which is exhausted outside. By

doing this and using fluorescent lighting wherever possible, the energy consumption of a residential home can be reduced substantially.

Passive solar homes are here to stay. We have quit building conventional homes altogether. Our projected sales for this year will exceed $1 million if the economy doesn't improve at all. If the economy does improve the second half as projected, our sales will exceed $1.5 million.

The recommendations I would like to make to this committee as far as drafting legislation to assist the solar industry is not to do anything. The best advice I can give you is to follow President Reagan's program of economic recovery, even if it means elimination of the Federal solar tax credit. Deregulation of natural gas has sold more of my homes than the solar tax credit ever will.

Iowa Energy Policy Council and the county extension services should keep doing their excellent job of informing the public of accurate information on solar energy and conservation. This is the best way to inform people of what needs to be done to their homes and businesses to conserve energy.

As far as the new housing industry, you will see a substantial increase in the number of passive solar homes being built in Iowa in the next few years and by the end of this decade, passive solar homes will be a very common sight.

Right now the best thing we can do to promote growth in the passive solar housing industry is educating our architects, builders, the public and balancing the Federal budget so that there will be an ample supply of money in the private sector for building new homes.

Thank you.

[The prepared statement of Mr. Ames follows:]

Prepared Statement of Clair Ames on Passive Solar Homes

THE UNITED STATES AND IOWA SHARE A COMMON PROBLEM, AND THAT IS BOTH NEED TO IMPORT A SUBSTANTIAL AMOUNT OF THEIR ENERGY. THERE IS NO SINGLE SOLUTION TO THIS PROBLEM AND NO ONE PERSON OR FIRM CAN POSSIBLY COME UP WITH ALL THE ANSWERS FOR ALL THE QUESTIONS. MY PERSONAL CONTRIBUTION TO THIS CAUSE IS IN THE RESIDENTIAL AND LIGHT COMMERCIAL CONSTRUCTION INDUSTRY.

I MUST ADMIT THAT I AM NOT ENTIRELY MOTIVATED BY THE ENERGY SAVINGS FACTOR ALONE, THAT I ALSO HAVE PERSONAL GAIN IN MIND. THE KNOWLEDGE I HAVE GAINED FROM DESIGNING AND BUILDING THESE ENERGY SAVING PASSIVE SOLAR HOMES WILL MAKE ME THE LARGEST HOME BUILDER IN THE WATERLOO AREA WITHIN THE NEXT 2 YEARS. I AM IN THE PROCESS OF SETTING UP TO START MANUFACTURING PASSIVE SOLAR HOMES IN A FACTORY WHERE THEY WILL BE SHIPPED TO THE JOBSITE FOR ASSEMBLY. THIS OPERATION IS SCHEDULED TO START ON MARCH 1, 1982.

I STARTED WORKING IN THE CONSTRUCTION FIELD 13 YEARS AGO AND STARTED MY OWN BUSINESS 6 YEARS AGO. WE BUILT CONVENTIONAL WELL INSULATED HOMES FOR SEVERAL YEARS, AND I ALWAYS TRIED TO STAY ONE STEP AHEAD OF THE COMPETITION BY COMING UP WITH NEW IDEAS. I WAS ONE OF THE FIRST IN THE AREA TO START USING 6 INCH EXTERIOR WALLS, PUTTING 10 INCHES OF INSULATION IN THE ATTIC (INSTEAD OF THE NORMAL 6), AND INSTALLING CASEMENT WINDOWS IN ALL OF OUR HOMES (WHICH REDUCES INFILTRATION INTO THE HOME). I ALSO WAS ONE OF THE FIRST TO START USING TRIPLE GLAZED WINDOWS. AFTER DOING ALL THIS, I REALIZED THAT THERE WAS ONLY SO MUCH YOU COULD DO WITH INSULATION AND THAT THERE NEEDED TO BE ANOTHER ANSWER TO HEATING THE HOMES WITH THE PROJECTED INCREASES IN THE COSTS OF NATURAL GAS, FUEL OIL, ELECTRICITY, AND THE EVENTIAL DEPLETION OF FIREWOOD. THIS WAS WHEN I STARTED LOOKING INTO SOLAR AS A VIABLE ALTERNATIVE. I SPENT QUITE A BIT OF TIME RESEARCHING ACTIVE SOLAR HEATING, WHICH HAS FANS, BLOWERS, AND A DOZEN OTHER THINGS THAT CAN GO WRONG WITH THE SYSTEM. I CAME TO THE CONCLUSION THAT ACTIVE SOLAR WAS NOT THE ANSWER FOR NEW CONSTRUCTION. THEN I STARTED LEARNING ABOUT WHAT OTHER PEOPLE WERE DOING WITH PASSIVE SOLAR. THIS TYPE OF SOLAR REALLY MADE SENSE TO ME. INSTEAD OF HAVING A UNIT THAT YOU ATTACH TO A CONVENTIONAL HOME, YOU DESIGNED THE HOME TO BE THE COLLECTOR AND THE STORAGE FOR THE HEAT COLLECTED DURING THE DAY. DOUBLE GLAZED PATIO DOOR GLASS

WAS THE OBVIOUS WAY TO GO WITH THE SOUTH WALL COLLECTOR, IT WAS INEXPENSIVE AND READILY AVAILABLE. I RESEARCHED THE DIFFERENT TYPES OF HEAT STORAGE MEDIUMS AVAILABLE: ROCK BED STORAGE, EUTECTIC SALTS, WATER, BRICK, AND CONCRETE. I CAME TO THE CONCLUSION THAT THE WATER STORAGE SYSTEM WOULD BE THE BEST, BUT THE MARKET DID NOT OFFER ANYTHING COMMERCIALLY FEASIBLE TO CONTAIN THE WATER, SO I DECIDED TO USE CONCRETE FOR THE HEAT STORAGE. CONCRETE IS GENERALLY USED IN THE CONSTRUCTION OF A HOME, SO IT WAS LOGICAL THAT CONCRETE COULD BE INSTALLED IN SUCH A WAY THAT IT COULD BE USED FOR THE HEAT STORAGE.

MY FIRST DESIGN WAS A 2 BEDROOM RANCH WITH A FULL BASEMENT. IT WAS A DIRECT GAIN DESIGN, WHICH MEANS THAT THE SUN IS ALLOWED TO SHINE DIRECTLY INTO THE HOME WITH THE CONCRETE STORAGE LOCATED IN THE INTERIOR, IN THIS CASE IT WAS A CONCRETE FLOOR BETWEEN THE BASEMENT AND THE UPPER LEVEL, LIKE IS USED IN A COMMERCIAL BUILDING. I HAD READ THAT ANY PASSIVE SOLAR HOME LOCATED NORTH OF KANSAS CITY MUST USE INSULATION OVER THE SOUTH WINDOWS AT NIGHT OR YOU WOULD LOSE MORE HEAT AT NIGHT THAN YOU GAINED DURING THE DAY. TO SOLVE THIS PROBLEM, I DEVISED A NIGHTTIME INSULATION DEVICE WHICH CONSISTED OF INSULATED GARAGE DOORS WHICH CAME DOWN OVER THE GLASS AT NIGHT TO REDUCE HEAT LOSS. I LEARNED AFTER THE FIRST HEATING SEASON, WHEN WE DIDN'T USE THE GARAGE DOORS, THAT THE NIGHT INSULATION ON THE SOUTH WINDOWS WAS NOT ALL THAT CRITICAL, AS IT COST ONLY $47.04 TO PROVIDE THE BACKUP HEAT FOR THIS HOME WITH NATURAL GAS!

THE NEXT THREE HOMES THAT WE BUILT WERE ALSO A DIRECT GAIN DESIGN, BUT WITHOUT THE NIGHT INSULATION. THE THIRD HOME THAT I BUILT WAS FOR MY FAMILY. WE MOVED INTO IT SEPTEMBER 26, 1980. THIS HOME IS A TWO LEVEL DESIGN WITH DIRECT GAIN ON THE UPPER LEVEL, USING A CONCRETE FLOOR FOR STORAGE, THE SAME AS THE FIRST SOLAR HOME WE BUILT. THE LOWER LEVEL USES A CONCRETE TROMBE WALL. A TROMBE WALL IS A MASONRY SOUTH FACING WALL THAT COLLECTS AND RELEASES STORED HEAT INTO A BUILDING BY BOTH RADIANT AND CONVECTIVE MEANS. THIS WALL IS INSULATED FROM THE EXTERIOR BY DOUBLE GLAZED GLASS.

I INSTALLED THERMOMETERS AT VARIOUS LOCATIONS IN OUR HOME TO MONITER THE TEMPERATURE FLUCTUATIONS. THE THERMOMETERS WERE READ AND RECORDED DAILY ALONG WITH THE OUTDOOR TEMPERATURES. BY SPRING I HAD COLLECTED ENOUGH DATA ON THE HOME TO COME TO THE CONCLUSION THAT THE TROMBE WALL DESIGN USED ON THE LOWER LEVEL PERFORMED BETTER THAN THE DIRECT GAIN ON THE UPPER LEVEL. BOTH UPPER AND LOWER LEVELS HAD AN AVERAGE TEMPERATURE OF 71 DEGREES, BUT THE DIRECT GAIN DESIGN HAD A MUCH LARGER TEMPERATURE

FLUCTUATION THAN THE TROMBE WALL DESIGN. THE COST FOR HEATING MY 1700 SQ. FT. HOME THAT WINTER WAS $58.86 WITH NATURAL GAS AS BACKUP HEAT.

WITH POTENTIAL CLIENTS PREFERRING RANCH HOMES, IN NOVEMBER OF 1980, I DESIGNED A RANCH STYLE HOME USING A COMBINATION DIRECT GAIN AND A CONCRETE TROMBE WALL. I DESIGNED JUST ENOUGH DIRECT GAIN SO THAT THE STRUCTURE WOULD NOT OVER HEAT WITHOUT ANY ADDITIONAL INTERIOR MASS, OTHER THAN WOULD NORMALLY BE FOUND IN A CONVENTIONAL HOME. AFTER CONSULTING WITH PHIL SVANOE AND RICH MERCER, OF THE IOWA ENERGY POLICY COUNCIL, I WAS ABLE TO FINALIZE THE DESIGN. THIS DESIGN HAD A GREAT MARKET APPEAL AND BY THE END OF 1981, WE HAD BUILT 11 HOMES WITH THIS TYPE OF DESIGN, FOR A TOTAL SALES VOLUME OF $867,000. CONSIDERING WHAT THE ECONOMY WAS DOING AND WITH INTEREST RATES HOVERING AROUND 15% TO 18%, THAT WASN'T TOO BAD.

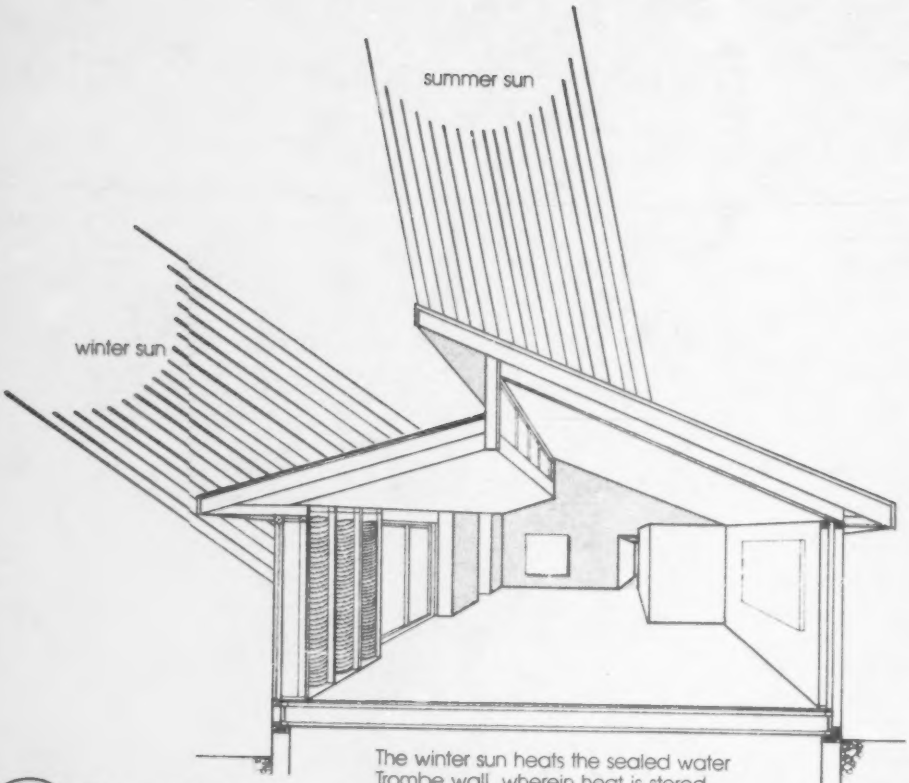
WITH THE NUMBER OF SALES ACHEIVED IN 1981, AND WITH PROJECTED SALES FOR 1982, IT REQUIRED THAT I REDESIGN THESE POPULAR PASSIVE SOLAR HOMES SO THAT THEY CAN BE MANUFACTURED FOR MASS PRODUCTION. THE CONCRETE TROMBE WALL HAD TO BE REPLACED WITH A HEAT STORAGE MATERIAL THAT COULD BE TRANSPORTED FROM THE FACTORY TO THE JOBSITE. THERE AGAIN, THE MOST LOGICAL SOLUTION WAS TO GO WITH A WATER STORAGE SYSTEM. WATER IS ALWAYS AVAILABLE AT THE JOBSITE AND IS INEXPENSIVE, BUT I STILL HAD THE PROBLEM OF THE AVAILABILITY OF A COMMERCIAL UNIT THAT COULD BE PURCHASED AT A REASONABLE PRICE. THAT IS WHEN I DECIDED THAT I WAS GOING TO HAVE TO DESIGN AND BUILD MY OWN UNITS. AFTER RESEARCHING SEVERAL COMMERCIALLY AVAILABLE PRODUCTS TO BUILD THE WATER TROMBE UNITS, I DISCOVERED WHAT I NEEDED WAS AVAILABLE IN MY OLD HOME TOWN OF OELWEIN. ITHEY ARE 10 INCH ABS BLACK PLASTIC NON-PERFORATED DRAIN TILE. WHEN FILLED WITH WATER, CAPPED, AND STOOD ON END, THEY BECOME IDEAL HEAT STORAGE UNITS. THESE UNITS ARE THEN PLACED WITHIN 4 INCHES OF THE SOUTH FACING GLASS. ON THE INTERIOR, 1/2 INCH DRYWALL IS PLACED DIRECTLY AGAINST THE WATER TROMEE UNITS TO GIVE THE INTERIOR THE LOOK OF A CONVENTIONAL WALL. THE SUNS RAYS PENETRATE THE GLASS AND THE HEAT IS ABSORBED BY THE WATER TROMBE UNITS. THE HEAT IS THEN NATURALLY RADIATED THROUGH THE DRYWALL TO HEAT THE INTERIOR OF THE HOME.

THE SOLAR PORTION OF THE HOME IS NOT THE TOTAL SECRET TO BUILDING A HOME THAT WILL PERFORM AS WELL AS OUR HOMES DO IT STARTS WITH GETTING A COMPLETE UNDERSTANDING OF HOW THE COLD FROM THE OUTSIDE GETS INTO YOUR WARM HOME TO BEGIN WITH. A HOME MUST BE BUILT AS AIR TIGHT AS POSSIBLE. THE BEST

WAY TO VISUALIZE THIS IS TO THINK OF YOUR HOME AS A SUBMARINE AND IF IT WERE TO BE SUBMERGED IN WATER WHERE WOULD IT LEAK? THEN, CAULK THESE AREAS WITH SILICONE CAULK TO SEAL UP THE LEAKS. ONE OF THE PRIMARY THINGS OF A SUBMARINE IS THE ENTRYWAY. YOU DON'T ENTER THE SUBMARINE FROM DIRECTLY OUTSIDE OR THE SUBMARINE WOULD SINK. THE SAME IS TRUE FOR A HOME. YOU DON'T ENTER IT DIRECTLY FROM THE OUTSIDE OR YOU LOSE ALL THE AIR WHICH WAS HEATED BY YOUR FURNACE OR THE SUN. AN AIR LOCK ENTRY IS USED TO PREVENT THIS. I ALSO DESIGN ALL OF OUR HOMES WITH 10 INCH EXTERIOR WALLS ON THE NORTH, EAST, AND WEST SIDES OF THE HOME. THESE ARE THEN INSULATED WITH FIBERGLASS BATT INSULATION TO ACHEIVE AN R-VALUE OF 35. THE ATTICS ARE THEN INSULATED TO AN R-VALUE OF 60. TO CONTROL THE QUALITY OF THE AIR IN THE HOME AND TO CONTROL HUMIDITY WE INSTALL AIR-TO-AIR HEAT EXCHANGERS, WHICH REDUCE THE HEAT LOAD BY RECOVERING HEAT FROM THE AIR WHICH IS EXHAUSTED OUTSIDE. BY DOING THIS, AND USING FLORESCENT LIGHTING WHERE EVER POSSIBLE THE ENERGY CONSUMPTION OF A RESIDENTIAL HOME CAN BE REDUCED SUBSTANTIALLY.

PASSIVE SOLAR HOMES ARE HERE TO STAY. WE HAVE QUIT BUILDING "CONVENTIONAL" HOMES ALTOGETHER. OUR PROJECTED SALES FOR THIS YEAR WILL WELL EXCEED 1 MILLION DOLLARS IF THE ECONOMY DOESN'T IMPROVE AT ALL. IF THE ECONOMY DOES IMPROVE IN THE SECOND HALF AS PROJECTED, OUR SALES WILL EXCEED 1.5 MILLION DOLLARS.

THE RECOMMENDATIONS I WOULD LIKE TO MAKE TO THIS COMMITTEE AS FAR AS DRAFTING LEGISLATION TO ASSIST THE SOLAR INDUSTRY IS NOT TO DO ANYTHING. THE BEST ADVICE I CAN GIVE YOU IS TO FOLLOW PRESIDENT REAGAN'S PROGRAM OF ECONOMIC RECOVERY EVEN IF IT MEANS ELIMINATION OF THE FEDERAL SOLAR TAX CREDIT. DEREGULATION OF NATURAL GAS HAS SOLD MORE OF MY HOMES THAN THE SOLAR TAX CREDIT EVER WILL. THE IOWA ENERGY POLICY COUNCIL AND THE COUNTY EXTENSION SERVICES SHOULD KEEP DOING THEIR EXCELLENT JOB OF INFORMING THE PUBLIC WITH ACCURATE INFORMATION ON SOLAR ENERGY AND CONSERVATION. THIS IS THE BEST WAY TO INFORM PEOPLE OF WHAT NEEDS TO BE DONE TO THEIR HOMES AND BUSINESSES TO CONSERVE ENERGY. AS FAR AS THE NEW HOUSING INDUSTRY, YOU WILL SEE A SUBSTANTIAL INCREASE IN THE NUMBER OF PASSIVE SOLAR HOMES BEING BUILT IN IOWA IN THE NEXT FEW YEARS AND BY THE END OF THIS DECADE PASSIVE SOLAR HOMES WILL BE A VERY COMMON SIGHT. RIGHT NOW THE BEST THING WE CAN DO TO PROMOTE GROWTH IN THE PASSIVE SOLAR HOUSING INDUSTRY IS EDUCATING ARCHITECTS, BUILDERS, THE PUBLIC, AND BALANCING THE FEDERAL BUDGET SO THERE WILL BE AN AMPLE SUPPLY OF MONEY IN THE PRIVATE SECTOR FOR BUILDING NEW HOMES.



Ames Building Corporation
Passive Solar Homes

The winter sun heats the sealed water Trombe wall, wherein heat is stored and radiated to the interior of the home.

Direct heat gain is admitted as sunlight into the home through the South facing windows. The North, East, and West walls feature 10 inch staggered stud walls, insulated to an R-35 and the ceilings are insulated to an R-60 to minimize the heat loss. The home is caulked and sealed to nearly eliminate infiltration.

The overhang is designed to prevent the summer sun from shining into the home and onto the water Trombe wall. This design can be built on concrete block, poured wall or wood foundation.

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Corporation

Ames Building
Corporation

Mr. HARKIN. Thank you very much, Mr. Ames.

We talked earlier about the indoor air quality. You bring up an interesting idea, an air-to-air heat exchanger. In other words you take the air going out of the house that is hot and heat the air that is on the outside as you bring it in.

Do you use it around the chimney or something like that?

Mr. AMES. OK, what it is you normally have exhaust fans in a conventional home which exhausts moisture and foul air from cooking and things like that to the outside.

Mr. HARKIN. Like in the attic.

Mr. AMES. Right, and either exhaust it into the attic or directly outside, and what this unit does is it exhausts air just like a regular exhaust fan does only it brings in the air from the outside to replace the outgoing air.

Normally, when a conventional exhaust fan is going, exhausting air to the outside, you are going to have air leaking in from around doors and windows, replacing that outgoing air. And so what happens is when you are exhausting 70-degree air outside, you have zero-degree air coming in around doors and windows when the temperature is zero degrees outside.

What a heat exchanger does is when it exhausts 70-degree air outside and brings in fresh air from the outside, by the time the air gets brought into the home, it will be heated up to 50 degrees and that is just by using the air going out of the house.

Mr. HARKIN. Where do you buy your unit?

Mr. AMES. The heat exchanger units, I get them through Conservation Engineering which is a Mitsubishi brand. I know, but the United States has yet to come up with a good heat exchanger unit.

Mr. HARKIN. That is an air-to-air heat exchanger?

Mr. AMES. Yes.

Mr. HARKIN. How much does one cost?

Mr. AMES. The retail on them is $350. They do have a payback period as far as energy savings goes.

Dr. FRANKEL. You say one of the pieces of advice is to continue with the President's economic recovery programs but one part of that program is to cut out the parts of the Federal energy effort that provide the kind of information that you are talking about, the part that tests out these heat exchangers. Does that mean you want to eliminate that part of the program, too?

Mr. AMES. I think the program has gone along far enough where the information that is available on the market is there. You just have to look for it. My own personal opinion on it is that we can start cutting back on some of these programs that were needed up to a point to do the research and things on this. But I think the research is far enough along where I think if you turn it over to the marketplace now and let the marketplace develop the product.

Dr. FRANKEL. What about the job of educating architects, builders and the public which you recommend?

Mr. AMES. OK, this would be done like through seminars like our Iowa Energy Policy Council has promoted and things like that as a good education type program. And you do need someplace in the Government that you can go to for information, as such. This doesn't have to be an elaborate system, something like the county extension services and Iowa Energy Policy Council. Leave it on a

state level versus a national level would be the best program because what is good for Iowa is not necessarily good for Florida. You have different climates and things.

Whereas if you leave it with the State governments, they can do what applies to that State and it can be done more effectively.

Mr. HARKIN. You think the States ought to pay for it, too, because that costs money, right?

Mr. AMES. Sure. I think the States should, yes. Then that way it would be up to the States to determine how far they wanted to go with the programs.

Mr. STEINWAY. The Congress over the last couple of years has debated merits of a passive solar tax credit. How do you feel about that?

Mr. AMES. Like I said, I think the Government should start scaling back on a lot of things. I would like to see them eliminate entirely the solar tax credit because all the solar tax credit has done is to allow people to go out and sell $500 solar collectors for $800, because the people know they will be getting 40 percent back on their tax credit.

And as far as passive solar goes, it has been detrimental to the passive industry because the solar tax credit currently in effect is more geared up for the active solar than it is for the passive.

I have modified my designs to take advantage of the Federal solar tax credit but like I said, the deregulation of natural gas has helped sell more of my houses than the solar tax credit has.

Mr. STEINWAY. Just a follow-up question: In the Energy Security Act, the Congress establishes a solar and conservation bank. Mr. Burns, what do you feel about the merits of that bank? It is supposed to be funded this year at $25 million?

Mr. BURNS. I really don't understand the background of your question. Would you repeat it?

Mr. STEINWAY. In the Energy Security Act, one of the incentives that was provided by Congress was the creation of a solar and conservation bank. That bank would provide subsidies to banks out in the field to provide low-interest loans and in some instances grants to eligible customers for solar and conservation techniques and measures.

Mr. BURNS. I am not against any aid to people who are in need of that aid. The question is where do you cut off the aid? We found out in programs administered by the Government many times, we felt that their aims were much too high. They invaded the private sector by the limits they placed on the loan applications, $30,000-a-year incomes.

If you are talking about people that are truly disadvantaged, I think that might be an idea worthy of consideration.

Mr. HARKIN. Of course, one of the ideas behind the solar and conservation bank is similar to the old REC legislation. If we had waited for the marketplace to bring electricity and telephone service to the rural areas, I think probably some of our farms might still not have electricity and telephone service. So obviously, it was a social policy to get that out there.

Mr. BURNS. Yes.

Mr. HARKIN. And we have looked upon the solar and conservation bank as the same thing. The National Energy Security Act

was saying that we should have a national policy of doing something like this. The marketplace will take care of people that can afford to buy Mr. Ames' homes but will the marketplace take care of the vast other network out there?

Mr. BURNS. Well, it depends upon again the definition of what that vast other network is and what the marketplace is to the person who can afford it. There is sort of a race on right now, in my own mind. I don't want to see a hoard of government inspectors sticking their heads up all over the country looking at attic insulation. I would rather private industry would handle it.

Mr. HARKIN. I would, too, if we could——

Mr. BURNS. It is sort of a race if they are going to be doing it. It sounds, listening to the utility people, that that is maybe well underway.

Mr. HARKIN. Yes; that would be good if we could get the utilities in this country to do that. Some of them are taking the lead but others are not.

Mr. BURNS. Well, the same way in the financial field. We see some lenders are taking the lead and more of them will come along in that direction, hopefully, quite rapidly.

Mr. HARKIN. We do need leadership in that area. We need leadership both in the private sector and in the Government sector, too. We need to take things like those you are doing and pull in the rest of the banks and S. & L.'s in the State of Iowa to say, "Look, we can do this." Bring in the realtors and homebuilders.

What Mr. Ames is doing, for example, I venture to say there are not many builders in the State of Iowa that know of what you are doing and how you are proceeding. A few, maybe, I don't know. But what you are doing and what you have accomplished ought to be part of an information program. It takes some leadership, on the State level, to do that. It doesn't cost a lot of money.

The solar and conservation bank is one that we have had some problems with. Again, obviously it is a question of where do you cut the Federal subsidy off. But we see a vast need out there and by the time the marketplace responds—again I go back to the old REC—when? We are trying to collapse that timeframe.

What is the biggest obstacle, Mr. Ames, to a builder who wants to build a passive solar home? What is the biggest obstacle? Knowledge?

Mr. AMES. Yes; knowledge is about the biggest obstacle to them right now and you are going to find homebuilders and there are getting more and more all the time that are interested in getting into it and then there are a lot of your older homebuilders that just, you know, don't want to change their ways. They just want to keep doing things the way they have been. That is about the biggest obstacle.

Mr. HARKIN. Now, you heard—you were here before and you probably heard my question to Mr. Birdsall about municipal utilities and about municipal codes, what municipalities can do in terms of their building codes.

How would you react to municipalities passing codes that said new homes have to incorporate some passive solar design? Would that be something that could be done?

Mr. AMES. That would be very possible. In fact, I would even like to see it done on a State level and what could easily be done is to direct the Iowa Energy Policy Council to come up with a training program for building inspectors around the State to train them how to spot passive designs, what to look for and things along this line, and then put out a directive, new homes built have to be oriented to the south to incorporate a certain percentage of area with glass, and have to incorporate a certain amount of mass into the home.

Mr. HARKIN. I assume that there would be some negative reaction to this by homebuilders. No one likes to be told what to do.

Mr. AMES. Well, that is true. That is the whole problem right there. You can encourage somebody to do it versus tell them to do it. You are much better off.

Mr. HARKIN. But sometimes, again, we are facing a situation, like we are in the State of Iowa, of massive increases in the cost of energy, as in other energy-importing States like Wisconsin and Michigan. Perhaps we do need to do something. I mean, we don't want the Government to force us to do anything. Sometimes we get mad at that. But sometimes it is for the good of all of us for the Government to do it. Sometimes, if I have to stop for a red light, I get angry because I can look around and see there is no traffic coming. Why can't I go through the red light? It is safe. But, for the benefit of all, we say stop at the red light.

Perhaps, the State of Iowa or other States could say to the homebuilders, "Maybe you don't like it, but for the good of all, we are going to pass these codes that say you have got to incorporate passive solar."

Mr. AMES. I think it is something—because the market is starting to demand it right now. People are really looking into passive solar as an alternative when they build houses. I have had a lot of people tell me that if it wasn't for the interest rates, "When I do build a house, that is the only way to go."

Mr. HARKIN. Now, I am going to get to Mr. Burns in a second. You are talking about new homes. Hopefully we will start building more this year.

Mr. AMES. Right.

Mr. HARKIN. Not only in Iowa, but all over the country. It seems we are now in a slump, as you know, in homebuilding all throughout the United States. Hopefully if interest rates come down and we start building new homes, it would seem that this would be the time, before we get into a new spurt of homebuilding, to incorporate these kinds of laws. I hope the States will do that.

Most of the homes, however, that are bought and sold are used homes.

Mr. BURNS. That is right. That is your big market.

Mr. HARKIN. That is your big market and that means retrofitting, making changes and that kind of thing.

Mr. BURNS. Yes.

Mr. HARKIN. Now, what is the biggest obstacle to that? If I have a home I am selling—in fact, I am selling a home—what is the biggest obstacle to having a lender come in and say, "Now is the time to take that 20-year-old home and incorporate some changes in it, add 10 percent to the cost and make it much more energy effi-

cient." Then build that added cost into the mortgage payments. What is the biggest obstacle?

Mr. BURNS. You are talking about the lender requiring that?

Mr. HARKIN. Yes.

Mr. BURNS. Across the board through all lenders? Or are you looking for volunteers?

Mr. HARKIN. Well, obviously, you have already done this.

Mr. BURNS. We have done that, yes. We have felt a little bit like FHA, having people avoid us at times because of the repair requirements. When a realtor lists a house, No. 1, he is looking to sell it as low as possible, get it onto the market to make his commission and move on to the next product. But people obviously want to get out. So why try to build something in that is going to make it more difficult, require a higher income to qualify for the loan, the more you add to it? So people feel that the home prices have inflated so greatly, why push it up higher.

Mr. HARKIN. But if you are buying a home—what does the average home sell for in Iowa today, $40,000?

Mr. BURNS. No, more than that; I would say closer to $50,000.

Mr. HARKIN. The average home in Iowa is $50,000. Now, 10 percent of that would be $5,000 to fix up the home quite a bit.

Mr. BURNS. It depends on how you fix it up. You can do it for a lot less than that.

Mr. HARKIN. I am talking about insulation. If it needs double pane window, put in double pane windows.

Mr. BURNS. Then that goes up quite rapidly.

Mr. HARKIN. Say you are talking about 5 percent. You are talking about $2,500 added onto that $50,000. Amortize that over the 20 years, and the monthly payments can't be that much more.

Mr. BURNS. No, the question is how fast is the payback and I am not sure that private industry can answer that question, that anybody in the business can really say how fast the payback periods are. We don't really know.

Dr. FRANKEL. You have some data now.

Mr. BURNS. Well, I was talking to people like Owens Corning Fiberglass here a couple of years ago. They were trying to come up with those answers and I haven't seen those answers yet.

Mr. HARKIN. Is this an area for State law?

Mr. BURNS. It is an area worthy of consideration. The time to really effect a change is when there is a sale made. That is the most vulnerable time. Somebody wants to sell a house, the title is going to pass, the deed is going to be recorded, a new mortgage made. Otherwise you are relying only upon education and telling people to protect themselves from their higher utility bills by volunteering to do these types of things. If they have to do it at the time of sale, obviously they are much more apt to do it to get the sale completed.

Mr. HARKIN. I would say, let the State have a legal requirement that every home that changes hands has to meet a certain minimum energy efficiency. Either that or at least 5 percent of its sale price must be put in to energy efficiency improvements, storm windows, storm doors, that kind of thing. It is kind of an either/or type of thing. I mean some homes might need an additional 20 per-

cent of the costs to meet a certain minimum standard. You just couldn't afford to do it.

Mr. BURNS. I am sympathetic to the logic of the approach. I am not particularly sympathetic to making that into State law, per se. I would rather face the problem through other means, for instance, Freddie Mac and Fanny Mae, saying, "We aren't going to buy loans from you lenders unless they meet these certain requirements" working through the lenders. If somebody wants to privately finance a house, pay cash for it outside and they don't want an energy efficient home, I hate to shove it down their throat and say, "You are going to have to have it."

Mr. HARKIN. How about this one: How about the idea of labeling homes for their energy efficiency?

Mr. BURNS. Like you do a refrigerator or whatever?

Mr. HARKIN. You bet. Would banks be willing to offer special financing packages to homes that are labeled energy efficient?

Mr. BURNS. I would think so. I should think there would be enough there to make it an incentive to offer better loan terms.

Mr. HARKIN. What do you think about that?

Mr. AMES. I think it is a good idea in concept, but I think it is going to be tough to establish in existing homes, you know, exactly what the infiltration rate is into the house, whether the windows are tight, or not, just by visual appearance and, you know, for that matter, if the walls are insulated in the house without actually boring a hole into the wall to determine whether they are.

Mr. HARKIN. What about infrared scanners?

Mr. AMES. That would be the only possibility. But, you know, if you are looking at a $10,000 investment per savings and loan, I think you are going to get a little static there.

Mr. HARKIN. I don't know; there are a lot of homes out there. Perhaps a realtor might want to invest in something like that.

One other thing I had for both of you—for Mr. Burns, why can't banks, S. & L.'s simply agree to offer lower interest rates or lower down payments for people who buy energy efficient homes? In other words, something similar to what the utility was talking about earlier. Why can't banks and S. & L.'s do that?

Mr. BURNS. Well, because S. & L.'s—I can't speak for banks right now—but S. & L.'s are in a negative cash flow position. They are severely crippled both as inflow of cash and operating profits. So when you take on the two, you are not thinking of Santa Claus ideas. You are holding on for dear life and saying, "Maybe we will get out of this recession in a year or so and get back to normal." If you are talking normal times, that is something entirely different.

Mr. HARKIN. What about Rule Q? That has nothing to do with this.

Mr. BURNS. Well, I don't know. I used to think so. I am not too sure now. I am wondering about the thrift position as a housing leader. A lot of them are taking a very hard look at it. They say the State has held us down on one side of the ledger on our loans as to the fees we can charge and what we can do on the sales clause, and yet they have released us where we can pay 14–15 percent interest to our people, and it has put us in a very bad position.

So they are starting to think maybe we should go into commercial lending, car loans and all sorts of things that will turn over

the money faster and make more profit. Before you can help anybody you have to be in the rowboat yourself reaching out to pull somebody out of the water. If you are out in the water with them, you can't help anybody.

Mr. HARKIN. Do S. & L.'s consider utility bill projections in their estimates of a person's financial ability to make payments?

Mr. BURNS. Up until recently, most S. & L.'s housing lenders did not. We have for years, yet basically it is not recognized in the national market. They look at your monthly payments to Sears, Younkers, Wards, et cetera, along with your income. They do not consider basically housing costs, per se. They are only now setting up to take a closer look at it.

As the delinquency ratios rise, they will start looking at them more closely.

Dr. FRANKEL. Mr. Maggiore, if you were given free reign to design programs to provide capital for weatherizing poor peoples' homes, what would you do? If you had a blank check to design an effective program, what would you do with it?

Mr. MAGGIORE. The goal would be optimal weatherization, approaching concepts similar to the super-insulated house, where it is worthwhile doing that by using community labor to make it labor-intensive in terms of creating jobs with a very heavy training program.

I would go beyond just community action agencies to deliver this. I would go to a number of other entities to make it relatively large. I would continue the current DOE regs but conceptually with a super-insulated perspective. So that you have airtight homes. I would take some of the designs that are coming out of the National Center for Appropriate Technology, which are more advanced than DOE regs in terms of energy-saving features and tie that into it.

I would make quicker decisions than the DOE program does on whether it is even worthwhile to weatherize certain homes. I would set guidelines that would limit activities in homes where it is a waste of money to weatherize.

So we take a different conceptual framework but it definitely can be done and it can be implemented quickly with enormous employment and training possibilities tied to it. Not CETA, I am not talking about CETA. I am talking about a different kind of training program for people out of work. With a focus to on the job training in technical areas and less Federal restrictions.

Dr. FRANKEL. Do you think there is any merit in requiring a certain fraction of low-income energy assistance funds go to weatherization? Right now it is optional but 15 percent can be set aside for weatherization. However, in States where they have people screaming for money for their fuel bills, they are not likely to set aside money for weatherization. Do you think increasing the low-income energy assistance fund by 15 percent and then requiring that 15 percent to be set aside would be a good approach to weatherization?

Mr. MAGGIORE. No, I think it confuses the issue between the income needs of people who need fuel assistance and the housing weatherization needs for people who need a more energy-conserving environment to live in. The States currently have two discretions. One of them is 10 percent transferability to title XX for

purely social service programs. The other is 15 percent transferability to weatherization. It is near certain that most States in the country will automatically transfer the 10 percent which has nothing to do with energy to the title XX program.

So that practically—not conceptually—by law, 25 percent of the total amount of energy assistance funds can currently be transferred. To me, that is crazy. If you are going to give a State a revenue sharing grant, you give them a revenue sharing grant. You don't call it energy and then allow them to transfer it all over the place.

I think such discretion is detrimental to low-income people because title XX serves people in a variety of income ranges and it is easy to steal from the poor and it is done in many, many ways. It is done in the marketplace and it is done by government. It is done by oil companies.

I was on the committee that reviewed the oil company overcharges by the Department of Energy a year ago. We arrived at a conclusion that they overcharged $16 billion—to the public. They returned $1 billion. Now, even a national syndicate would have a tremendous investment on those kinds of ratios, 1 to 16. Equally important is that the 16-billion estimate was probably inaccurate and low.

Canada did the same study; they found $32 billion. Now, Canada, it is my understanding, is a small country, less people. Now, how could our oil companies overcharge 32 billion in Canada and only 16 in the United States? The data base is highly questionable. It is probably much more than 16.

The issue, though, is what is overcharging and for many of us who work in the central cities throughout the country, it is stealing. Whether you are stealing from a vendor in the downtown area of Milwaukee, or an oil company overcharging the public, it is stealing.

When you look at stealing relative to the poor, whether it is government, administration or the marketplace, it is all the same. It is purely stealing. And as such activities relate to the cutbacks in social programs, the tension rate in the central cities will be seen to begin to emerge in major ways, will become a major social problem probably in less than 2 years.

So it isn't just energy; it is food stamps, whatever, but I don't want to get into a speech.

Mr. HARKIN. I like it. Keep going. I think you are putting your finger on it. I like someone who speaks frankly.

Dr. FRANKEL. You say you can see the tension rate rising. What do you see specifically?

Mr. MAGGIORE. Last week in Milwaukee we had some very severe weather. We went beyond our capability. We had 65–70° below-zero wind chill and it was about 28° below zero. We went beyond our capability of getting oil to low-income people. We had to open up shelters throughout the community, as well as go with relocating people in friends' homes. We had to mobilize the police and sheriff's department, on Saturday night through Sunday.

What we experienced in that process, was approximately 1,500 calls for help during that weekend, during the 2-day period. Which for us was relatively high in the city of Milwaukee. In New York,

it is my understanding, when they had similar weather the week before, they had over 10,000 such calls in a 2-day period.

We see not only people who are extremely deprived—none of this vision of middle-America that the poor have Cadillacs and big TV sets. That may be true for 1 or 2 percent of poor people, a very small percentage, but it is certainly not true for the mass numbers. But we also saw the beginnings of hostility that we saw in the 1960's. I have been involved in inner city activities since the 1960's, and we went through a very unique period of how people relate to helpers. We are beginning to see a kind of hostile paranoia on an individual basis that we haven't seen in a number of years. An attitude of hopelessness.

So you begin to see the seeds. I think the seeds were planted several years ago and its little flowers are beginning to bloom. It is not just racial at all. It is more of a class thing. You have more middle-income people entering the poverty ranks who had two cars and can only afford one and that one is no longer any good. They are very hostile about being in the same lines as people who are traditionally identified as being poor.

So you have many different social factors converging in the current situation, which is creating enormous political, practical and security problems in the future, at least the potential for serious problems.

Mr. HARKIN. Let's talk about that just a second in terms of budgets. The fiscal year 1982 budget, the one that we are on right now, has $144 million for weatherization. The request for fiscal year 1983 is zero. And fiscal year 1982, we had $450 million total for all our needs, conservation R. & D. grants, weatherization, schools and hospitals and State energy conservation programs, $450 million.

Fiscal year 1983 request is $19.4 million. That is for everything. That is the whole thing. And so we start looking at that and we see what is happening to poor people. On the one hand, we have $1.8 billion that we have appropriated for low-income energy assistance and it is a good program and it is needed. We can see how it is needed. So you give them $1.8 billion so that they can go out and pay their gas bills or heating oil bills or whatever. On the other hand, the program that would enable them next year or the year after to not have to pay that much through weatherizing, it is being cut to zero.

What kind of public policy is that that will take from the taxpayers of this country $1.8 billion to pay high-priced energy costs, but not give even $144 million, as we did last year, for weatherization? It seems to me a crazy public policy that we are engaged in.

When you talk about the poor, and I serve on the agriculture committee, too, where we have food stamps. Data shows that poor people—you know, you always hear about how the average consumer in the United States pays a lower part of their income for food than any country in the world and it is true—but poor people pay a lot more than the average. In this country, poor people eligible for food stamps below the poverty line, below that 125 percent of poverty line, are paying upwards of 50 percent—40 to 50 percent in some cases—of their total income just for their food.

You add onto that 35 percent that they spend on energy, and you have got 75 percent of all their money going for food and energy.

They have got to buy clothes and they have got to pay other bills——

Mr. BURNS. Make a mortgage payment.

Mr. HARKIN. And make a mortgage payment. [Laughter.]

Mr. BURNS. They have got to have a place to sleep, you know.

Mr. HARKIN. That is right.

To get back to what I said initially, if we who are fairly affluent feel the pinch of higher energy bills, think what it is doing to poor people. And yet we are gutting the very programs that help reduce those energy bills. And it is not just a reduction—it is a wholesale gutting of those programs.

So what are we going to do? It seems to me it is a national problem because energy goes into the whole pot. If poor people are using a lot of energy and wasting it in energy-inefficient homes, it is not only penalizing them individually, it is penalizing all of us.

So how are we going to get the public aware that they also have a stake in it? I know I am speechifying here, but I want to point out not only for the benefit of the people here, but you also, Mr. Burns, Mr. Ames, everybody, that this is a problem that you can't sweep under the carpet. It is there.

Do we, as a public policy, continue to increase that $1.8 billion? Is it going to be $2.8 billion next year to help them pay their fuel bills and $3 billion the year after, or do we put more money into weatherization, which has longer-term benefits?

Now, you are taxpayers. What do you think we ought to do? What do you think, Mr. Ames?

Mr. AMES. Well, I think, you know, weatherization. I would rather see it put in there than fuel subsidies myself. I would like to see the fuel subsidies completely eliminated if possible, and put the money toward weatherization if the Government has that money to spend on it.

Mr. HARKIN. Well, I think it ought to be at least 50–50. But, you know, when a person is in a home and it is energy inefficient—I have been in a lot of them in the congressional district that I represent—and that monthly heating bill comes in, they have got to pay it. It makes an immediate need. They can't wait to be weatherized because there is a long waiting list. And they may get weatherized next year but not this year.

What do you think, Mr. Burns?

Mr. BURNS. I agree with Mr. Ames. I would rather see it go into weatherization and I think some provision should be made if people are going to continue receiving aid to heating homes, they should be energy-efficient homes or else the aid should be decreased or cut off on those homes.

Mr. HARKIN. Mr. Maggiore, what is your opinion? How do you see this?

Mr. MAGGIORE. You really have to have both. I don't think any of us want people to die. If they don't have fuel assistance funds, they will die. It is as clear as that. They have died before.

When many of us created the fuel assistance program a number of years ago, we had documented for 2 consecutive years that in excess of 300 Americans had died because they were poor and did not have enough fuel to heat their homes. That helped create that program legislatively. If we eliminate the program, we are going to

have to go back to that. We need both but they should be related to one another and that, if you have your home weatherized, theoretically, you should have less fuel assistance, but not the elimination of it.

When one talks about the decontrol of natural gas, it compounds the problem beyond imagination. Decontrol of natural gas would have a severe burden on the average middle-American, and devastate the poor, absolutely devastate the poor.

The other problem we have with the cuts is, worse than the money being cut, it is the concept that energy is no longer a problem; we don't need the Energy Department; the only Western country in the world that doesn't need an energy department. It is absolutely incredible.

What this does to our population is that energy is no longer a problem; therefore, why conserve? Why do what the speakers on the panels have been talking about? There are real problems in how the President is selling his program, problems that he may not intend; problems he may intend in terms of putting everything into the marketplace.

So it is more than money. It is concepts that are being put out to the public now relative to conservation that I think are damaging.

Mr. HARKIN. In the last paragraph you mention in the State of Iowa a $101 million subsidy to low-income households would be necessary if a goal was to keep the annual income proportion of household expenses for energy the same as the average household in Iowa.

Would you tell me that again in terms that I can understand a little bit better?

Mr. MAGGIORE. According to the study, they indicate that throughout the country, and in Iowa—because I checked the Iowa data—that the average household in Iowa spends approximately 4 percent of their income for in-home energy. That is the average household in Iowa based on average income standards.

Mr. HARKIN. Four percent.

Mr. MAGGIORE. Four percent.

That if one wants poor people in Iowa to spend only 4 percent, you would have to give poor households in Iowa $101 million per year.

Mr. STEINWAY. That was 4 percent before taxes?

Mr. MAGGIORE. Before taxes; yes.

Mr. HARKIN. How would that be after taxes?

Mr. STEINWAY. Well, it would have been a higher number.

Mr. HARKIN. Mr. Maggiore, what has been your experience with the weatherization program to date?

Mr. MAGGIORE. It has been very good. It has been a learning experience throughout the country.

Mr. HARKIN. What improvements do you think are needed? Any improvements?

Mr. MAGGIORE. Well, what I have mentioned earlier, that once you move toward optimal weatherization of a home, that in some programs they have to go back. The Department of Energy, for example, in 1 year said, "We want numbers so do nothing but insulation. Don't do storm windows and storm doors, et cetera." Eventually they will come back and say, "Do storm doors and storm win-

dows," which means you go to a house twice. A vendor should never go to a house more than once. Go to the house, do the job and leave the house in terms of efficiency from a cost benefit perspective.

So that would be helpful if there were consistent guidelines. The current administration of the program is very good. Previously their administration was comparable to the failure rate of the Small Business Administration in terms of small businesses. But the latest administration is very good.

So right now I would say, other than the comments I have made, it is a very successful program. We have been very pleased.

Mr. HARKIN. Very good.

One last thing, probably Mr. Burns: What do you do about the nagging problem we always have of landlord/tenant relationship? In other words, the tenant says, "Why should I do anything? I don't own the place." And the landlord says, "Why should I do anything? I will just add it on to the rent."

Obviously this is a big problem. If the tenant pays the heating bill, why should the landlord have any motivation to weatherize?

Mr. BURNS. Well, from our viewpoint as a lender, the only time we have anything to say about an input is at the time they get a loan and then we have a lot to say about it. Other than that, I have nothing to say about it.

Mr. HARKIN. Ideas of how we might address this problem, breaking down that barrier somehow.

Mr. BURNS. Well, it is a problem. My wife owns a duplex and she pays the utilities so there is a problem.

Mr. HARKIN. Sure it is.

Mr. BURNS. So I don't know the answer to your problem but one that is, has to be addressed. There are an awful lot of rental units in town.

Mr. HARKIN. I am just seeking ideas.

Mr. AMES. Well, I think as fuel bills go up, I think because of the cost, people are going to be more willing to pay for an energy efficient apartment than they will for the one that is not as efficient and I think it will force the landlord into insulating the apartment just so he can keep it rented. I know there are a few in the Waterloo area that are like that right now.

Mr. HARKIN. Is it viable? In other words, what he is actually saying is, "I am a tenant." Of course, you don't know what the bills are going to be when you go into rent anyway.

Mr. AMES. A lot of people do, though.

Mr. BURNS. Well, a lot of people today when they buy a house, one of the things they ask the seller is what the utility bills have been. "Well, they have been running $85 a month or $135," but what is his lifestyle? Does he keep his thermostat at 65 or 75? And there is a big difference there. You don't know. The appraisers come along and they say if you have two houses sitting side by side, one is energy efficient and one is not, both are two-bedroom bungalows, they look exactly alike, same street, will the public pay *x* dollars more for the house that is energy efficient? And the appraisers at this point are not convinced they will. It is certainly not built into our data at this point that they will.

Mr. AMES. They are in the Waterloo area. It took quite awhile but I got them. I got them so they are.

Mr. HARKIN. A couple of questions and again state your name.

Mr. FLAHERTY. Rich Flaherty. I would like to say that one of the problems that we can address is that we don't have the data to calculate how energy efficient some houses are. And Jim Woods is sitting behind me and I know he is a mechanical engineer and I have spoken to him previously and I know that mechanical equipment to do this type of thing costs many, many dollars. But I think that is a wise investment so we can decide which type of house, passive solar, earth sheltered, active solar, is most beneficial or cost effective to build.

Mr. HARKIN. As Dr. Frankel pointed out, that is the kind of data that we were getting in the DOE program which now we don't have any money for.

Again, thank you very much. I appreciate it especially, Mr. Maggiore, coming the great distance that you did; Mr. Ames, keep up the good work in houses. As soon as I sell mine and I am ready to buy one, I will come to see you.

Our last panel, Mr. Jim Woods, Department of Mechanical Engineering, Iowa State; Mr. Eugene Sukup, president, Sukup Manufacturing Co., Sheffield, Iowa.

Dr. Woods, we appreciate your taking the time to come here and also Mr. Sukup. I am sorry that the Amana people couldn't be here because of the weather but they have some interesting testimony about what they are doing in appliances and how they are manufacturing energy efficient appliances. But we do have their testimony.

Dr. Woods, we have a copy of your statement. Without objection it will be made a part of the record in its entirety. We will call on you first and, again, please proceed as you so desire.

STATEMENT OF JAMES E. WOODS, PH. D., P.E., PROFESSOR, DEPARTMENTS OF MECHANICAL ENGINEERING AND ARCHITECTURE, IOWA STATE UNIVERSITY, AMES, IOWA

Dr. WOODS. Thank you, sir.

I will introduce myself briefly. I am Jim Woods from the Departments of Mechanical Engineering and Architecture at Iowa State University. Some of the previous experience I have had in energy and indoor environment includes serving now as a member and previously as chairman of the Building Energy Utilization Advisory Committee for the Energy Policy Council. I have been a member of the National Academy of Science committee on Indoor Pollutants. I chaired the ASHRAE Standard Project Committee 62 for revision of the standard: on "Ventiation for Acceptable Indoor Air Quality" and chaired the ASHRAE "presidential Ad Hoc Committee on Legionnaire's Disease."

The testimony I would like to present this morning basically has to do with energy use patterns and some of the research that we are conducting at the Building Energy Utilization Laboratory at Iowa State University.

Table I [1] gives the comparison of energy consumption patterns between 1975 and 1980 for four sectors of the Iowa economy: the residential, commercial, industrial and transportation. In the residential sector, direct consumption decreased by about 14 percent in the 5-year period, but electric consumption increased by 16 percent. Thus the net energy change in the residential sector over the last 5 years was zero. That is not a negative statement because there was some growth in the residential sector, but the energy savings were not what we anticipated they would be.

On the other hand a 9-percent decrease in direct consumption was realized in the commercial sector, and an additional 19-percent reduction occurred in electrical consumption. So we have seen an overall reduction of 13-percent energy consumption in the commercial sector in the last 5 years.

The industrial sector looks much like the residential sector: a decrease of about 4 percent in direct consumption, and 14-percent increase in electrical consumption for a net of no energy change in the last 5 years in the industrial sector.

In the transportation sector, a 16-percent decrease was achieved.

Thus, across all four sectors, an 11-percent decrease in direct consumption and about a 7-percent overall reduction was achieved in the State.

We recently presented these data at the 34th annual management conference that was sponsored by the Iowa Utility Association.

If we look at the data in another format, table II [2] we see by just comparing the residential and commercial sectors, that in the residential sector there was a 10-percent decrease in the use of natural gas in the 5-year period and a 24-percent decrease in petroleum, but a 52 percent in coal as a resource. Thus all of the savings achieved in natural gas and petroleum were compensated by an increase in electricity that was provided by coal. The net effect is no energy change.

We see in the commercial sector a 20-percent reduction in natural gas but a 17-percent increase in petroleum. I think this latter effect was probably due to the restrictions that were imposed on building permits for new buildings with natural gas as the fuel source in the middle 1970's. Thus people in the suburban and more rural areas in the nonresidential sector shifted to fuel oil as the primary source of heating.

Mr. HARKIN. Excuse me, Jim. Does that petroleum also include LP?

Dr. WOODS. Yes; all petroleum products. However, space heating would be primarily by LP. But also some fuel oil was used.

Thus in the nonresidential sector a shift occured away from natural gas to petroleum products and to a significant increase in electric consumption. The net effect was about a 13-percent reduction.

The consumption and resource patterns in Iowa generally tend to be similar to the national patterns. If you would look at the next chart (Fig. 1), [1] this is one that we have just finished and the results of this research are quite surprising. When we looked at

[1] Table I attached at end of testimony.
[2] Table II is attached at end of testimony.

annual energy consumption as a function of the date of construction of buildings, we considered three data sets: the first set was reported a couple of years ago by Syska and Hennessy, an engineering firm out of New York. The other two studies are those that we conducted in our laboratory. The 100 building set represented a cross-section of about 3,000 State-owned buildings. The set of 176 office buildings was chosen, another subject of the 3,000 buildings so we could look at one functional category.

Results of this study showed as much variation in energy consumption within a decade of construction as we see across all decades of construction. These results and other similar ones basically indicate that there may be some socially acceptable amount of energy consumption that we allow ourselves in buildings and it doesn't seem to make much difference whether we are dealing with northern environments or southern environments. For example I have looked at data from the Netherlands, from Germany, from Scandinavia and from several western European countries, and we see the same thing. The annual energy consumption is not that much different in the developed countries of the world.

Mr. HARKIN. You will have to tell me that again. I just can't seem to grasp the significance of this.

Dr. WOODS. OK, if we look at the data from an energy consumption standpoint, the older buildings may have a looser envelope and less insulation, but because of the type of heating system that was provided—say, perimeter radiation and no ventilation—the amount of energy provided for heating may be less. However, we know nothing from our data about the comfort factor that is associated with that energy consumption.

So, the newer buildings may be more efficient and they may also provide a better comfort value; thus we will be achieving more comfort and more productivity from the energy that we use today than we did in the older buildings. But if you evaluate the building performance only on energy terms, we don't see any difference.

Mr. HARKIN. That seems to beg the question how do you compare this with a building, for example, that was built in the same decade that is very energy efficient, that has a lot of glass facing the south, that was double paned, has windows that you can open in the spring and get fresh air? This doesn't tell us that.

Dr. WOODS. These data do not tell us anything about comfort factors—or system efficiencies. However, we have some other data that may address these points.

Mr. HARKIN. It would seem to me that would be an important component.

Dr. WOODS. Right. I intend to try to address that topic just briefly. I am going to deviate from the testimony a little bit and insert that so that we can discuss that.

Because Iowa has a relatively severe winter and summer seasons, the common misconception is that energy consumed for space cooling is about equal to that of space heating.

The data that we looked at indicate about seven times more energy is used annually for heating than for cooling a building. These data also indicate that on a peak heating day, the demand for energy at a building site is about three times greater than on a peak cooling day. Moreover, these data indicate that the annual de-

pletion rates of energy resources—that is the consumption of natural resources—for domestic water heating exceed those for space cooling in most residential facilities.

Much of the misconception about energy patterns in Iowa seem to occur because energy for space heating comes from diverse sources. While energy for cooling is primarily supplied as electricity.

Another misconception is that insulation, weatherstripping and caulking are always the most effective energy conservation measures that can be employed.

The data that we have looked at—and this includes about 6,000 buildings—indicate that about one-third of the energy consumed annually in buildings compensate for heat exchange through the building envelope; one-third compensates for occupancy profiles or occupancy loads, including lighting and ventilation; and one-third is consumed by parasitic losses such as fan motors and heat transferred through duct work and pipes.

These divisions are approximate but in agreement with results reported in other laboratories. Thus, heat exchange through a building envelope may account for more than one third of the annual energy consumption in an envelope-dominated building, such as a single-family residence but the envelope may account for less than a third in an internally-loaded building such as a large office building or a laboratory.

Moreover, if a 20-percent reduction in the envelope load could be achieved by insulation, caulking, and the weatherstripping, the impact on total energy consumption in the building would be at best, 20 percent of that one third or only about 7-percent savings in energy consumption.

The primary purpose of energy consumption in most facilities is to provide for the health and comfort of the occupant.

However, in response to the energy crisis, State and Federal regulations have been enacted which in the last decade have been potentially deleterious to the building occupants. Set points for temperatures and relative humidities have been decreased for winter and increased in summer, sometimes beyond the recognized limits of thermal acceptability and into the ranges of thermal stress. Ventilation has been reduced to minimum values during occupied periods and sometimes stopped during unoccupied periods. These reduced ventilation rates have resulted in increased concentration of contaminants such as tobacco smoke, formaldehyde, radon, other contaminants. Sometimes the values have exceeded recognized health limits by factors of 10 or more. Lighting levels of occupied spaces have been reduced sometimes by factors of two or more and little concern has been expressed regarding degradation of the quality of life, visual accuity or visual comfort.

Studies of environmental control strategies at our lab indicate the compromises between environmental quality and energy conservation are not always necessary. To the contrary, judicious election of energy conservation strategies can improve environmental qualities. However, as factors of safety are eliminated through energy conservation, buildings may become less forgiving environmentally. Thus demands for more precise and reliable control systems have been increased during the last decade.

Consumer regard of the cost effectiveness of environmental control has also increased as the cost of energy resources have escalated in the last decade. These costs are now sufficient to cause some confusion between the concepts of energy conservation and fiscal conservation.

Thus, many projects—for instance, some active solar energy systems—have been undertaken in Iowa, as well as elsewhere, which may have reduced the depletion of nonrenewable energy resources but which did not prove to be cost effective.

Conversely, conversions from electric resistance heating to wood- or coal-burning stoves may have reduced fuel bills for space heating but have not reduced the consumption of natural resources. Yet other measures, such as insulation of a single-family residence, have proven to be both energy conserving and cost effective.

Methods by which control strategies can be evaluated for energy conservation and for cost effectiveness have been pioneered at Iowa State University. Some of these methods are now incorporated in the State administrative rules, as lifecycle rate-of-return analysis are required for decisionmaking for new State-owned buildings.

As deregulation of fuel prices continues, the importance of these methods is expected to increase also. Thus, research at the Building Energy Utilization Laboratory should continue toward the objective of developing and reporting new information which can be used to provide cost effective, energy efficient and environmentally safe control within occupied spaces. Our research is expected to proceed with the rationale that energy consumption can be reduced while improving environmental quality. One example is to conserve energy by tightening the building envelope, which, in turn, may improve thermal comfort by eliminating drafts caused by infiltration.

Another example is maintenance of cooling towers. Recent evidence, reported by ASHRAE, indicates the proper maintenance not only increases energy efficiency but may also help to control the occurrence of legionnaire's disease.

A third example is the use of air-to-air heat exchangers or economizers in ventilation systems to provide inexpensive cooling with clean outdoor air during moderate seasons.

Some conservation practices can lead to reduced energy consumption while having little or no effect on indoor environmental quality. Ventilation shutdown and thermostat setback during unoccupied periods are common practices which reduce energy consumption without affecting the comfort of occupants.

Other possibilities include maintaining acceptable contaminant levels such as carbon dioxide by continuously controlling the ventilation rate in response to changes in occupancy load through the use of automatic feedback control systems.

This study that was recently completed through funding by the Department of Energy. The scientific results will be reported next week at the semi-annual meeting of ASHRAE.

Thus, it can be assumed that decreasing the energy consumption of the environmental control system may initially increase the quality of the indoor environment, but continued decreases in energy consumption will eventually degrade the environmental quality. Lifecycle costs may also initially decrease, then increase.

I would like to stress one point. It is the basis of where I think we should be going in energy conservation research. At this time, I believe that many buildings operate around condition I somewhere if in figure 2[1] relative to energy consumption versus lifecycle costs. Associated with that condition is some socially acceptable level of environmental quality that we can quantify (also shown in figure 2). We have techniques that we have been using to characterize these conditions.

If we judiciously select strategies, we will actually find that we can begin to increase the comfort of the space while decreasing both the energy consumption and the lifecycle costs.

The interesting thing is that there is no degradation in the quality of the indoor environment until energy consumption is reduced to values shown as point C. So, I think we should be looking at an attitude of using energy conservation as a measure of improving indoor air quality, rather than propagating the negative aspect of conservation which basically implies that people will be deprived of their lifestyle.

I do believe that you can, within certain limits, improve indoor air quality and increase energy efficiency.

I think with that, I would like to summarize quickly and then maybe we can get into some questions. I think there are three levels of priority in research that need to be addressed.

One has to do with methods of being able to predict and evaluate the impact energy conservation measures. At the present time, it is very difficult to predict how much energy consumption would be achieved if you adopted a certain energy conservation measure. There are some programs available, but very few. We have been doing some work in that area ourselves. DOE has spent quite a bit of money in the development of some of these programs. However, I am afraid that they are going to lose the impetus due to their program curtailments. Without good objective criteria on which we can evaluate energy conservation measures, we are not going to see an economic return on the invested dollar. I think it is imperative that we understand quantitatively what we are doing in this field.

Second, I think we have to understand, very well, what the environmental impact of conservation measures could be. The use of concrete for thermal storage is a viable energy alternative but depending on where the gravel or sand came from, it could have a high phosphorus content and, for instance, in the Ames area, we have high radon gas concentrations in the soil. In our research house we are seeing concentrations of radon that are at the health limits.

Mr. HARKIN. You are talking about the research house on campus?

Dr. WOODS. On campus, right.

Mr. HARKIN. Is the water the source of the gas?

Dr. WOODS. No; it is actually from the sand and gravel.

Mr. HARKIN. The sand and gravel is in the concrete?

Dr. WOODS. Yes; it is in the concrete, and it outgasses because we are using masonry or concrete that would have the radium that decays into the radon. Formaldehyde is another major problem in

[1] Figure 2 is attached to the end of the testimony.

both the insulation and the particle board. As we begin to tighten up the houses, which I think we have to do for energy effectiveness, we also have to take special care in providing for the environmental quality. We have had much controversy over both the radon and the formaldehyde as being potentially carcenogenic. Recent studies that have been recorded on formaldehyde are quite concerning.

An appeal on the ASHRAE ventilation standard recently occurred because some sectors of the industry felt that the standard had been set too tight. But the medical evidence tends to support that if the limit is going to change at all, it will probably be decreased. We have to understand those impacts.

Finally, we have to understand the cost effectiveness. You can say that we are going to weatherize a poor family's house. But if that really does not reduce their fuel bills, because they have an extravagant lifestyle or they don't understand how to live properly in a house, weatherizing a house is not going to reduce energy consumption even though it may reduce energy requirements.

So, I think I would leave it at that point.

[The prepared statement and biographical sketch of Dr. Woods follow:]

PREPARED STATEMENT OF JAMES E. WOODS, PH. D., P.E., PROFESSOR, DEPARTMENTS OF MECHANICAL ENGINEERING AND ARCHITECTURE, IOWA STATE UNIVERSITY

1.0 INTRODUCTION

The Building Energy Utilization Laboratory (BEUL) is comprised of faculty, professional staff, and students from a variety of disciplines. The focus of research in this laboratory is the study of energy utilization to provide for the needs of the occupants within buildings. The overall objective of this laboratory is to pursue interdisciplinary research which will lead to more efficient use of energy resources for acceptable environmental control within buildings.

The scope of the research conducted in this laboratory pertains to distribution of energy resources to building sites, utilization of renewable and non-renewable energy resources within the buildings, impact of energy utilization on the health, comfort and welfare of the occupants, and cost effectiveness of various alternatives. Buildings studied in this research include residential facilities, such as single family dwellings; commercial buildings, such as retail stores and offices; institutional buildings, such as schools and hospitals; and industrial buildings, such as manufacturing facilities. Buildings located within Iowa are primary subjects of this research, but comparative studies of energy use patterns in other states and countries are also included in the scope of this research.

2.0 BACKGROUND

Analysis of 1980 Energy Consumption Patterns in Iowa indicates that approximately 42% can be attributed to maintenance of environmental conditions within residential and commercial buildings (see Table 1). Assuming that about 10% of the energy consumed in the industrial sector is for environmental control, it can be concluded that approximately 50% of energy consumed annually in Iowa is for indoor environmental control.

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Table 1 also indicates that a 14% reduction in direct consumption of energy in the residential secotr has occurred since 1975, but that the increase in electrical consumption completely offset this reduction. A better conservation effort apparently occurred in the commercial sector as a 19% reduction in electrical consumption accompanied a 9% reduction in direct consumption to achieve a total energy reduction of 13%.

Table 2 indicates that all energy resources related to the residential sector in Iowa decreased except coal, which completely compensated for the annual demand. In the commercial sector, petroleum consumption also increased, probably due to restrictions imposed on the availability of natural gas for new building permits during the 1970s.

The consumption and resource patterns in Iowa generally tend to be similar to national patterns. Data analyzed at BEUL indicates that little correlation may be expected in annual energy consumption per unit floor area as a function of date of construction. As shown in Fig. 1, as much variance occurs within a decade as that across the last eight decades. Furthermore, data from New York [Klabin] tend to support this finding.

Because Iowa has relatively severe winter and summer seasons, a common misconception is that energy consumed for space cooling is about equal to that consumed for space heating. Data analyzed at BEUL indicate that about seven times more energy is used annually for heating than for cooling a building in Iowa. These data also indicate that on a peak heating day, the demand for energy at the building site is about three times greater than on a peak cooling day. Moreover, these data indicate that the annual depletion rates of energy resources (i.e., consumption of natural resources) for domestic water heating exceed those for space cooling in most residential

facilities. Much of the misconception about energy use patterns in Iowa seems to occur because energy for space heating comes from diverse sources (e.g., natural gas, fuel oil, and electricity), while energy for space cooling is primarily supplied as electricity.

Another common misconception is that insulation, weatherstripping, and caulking are always the most effective energy conservation methods that can be employed. Data analyzed at BEUL show that about 1/3 of the energy consumed annually in buildings compensates for heat exchange through the building envelope, 1/3 compensates for occupancy loads (e.g., lighting and ventilation), and 1/3 is consumed in parasitic loads such as fan motors and heat transfer through ductwork and pipes. These divisions are approximate, but are in agreement with results reported in other laboratories. Thus, heat exchange through the building envelope may account for more than 1/3 of the annual energy consumption in an "envelope dominated building" such as a single family residence, but the envelope may account for less than 1/3 in an "internally loaded building" such as a large office building or laboratory. Moreover, if a 20% reduction in the envelope load could be achieved by insulation, caulking and weatherstripping, the impact on total energy consumption in the building would be, at best, about 7% (i.e., 7% ≈ 20% x 33%).

The primary purpose of energy consumption in most facilities is to provide for the health and comfort of the occupants. However, in response to energy crises, state and federal regulations have been enacted within the last decade which have been potentially deleterious to the building occupants. Setpoints for space temperatures and relative humidities have been decreased for winter and increased for summer, sometimes beyond the recognized limits of thermal acceptability and into the ranges of thermal stress. Ventilation has been reduced to minimum values during occupied periods and, sometimes,

stopped during unoccupied periods. These reduced ventilation rates have resulted in increased concentrations of contaminants (e.g., tobacco smoke, formaldehyde, NO_x, SO_2, radon), sometimes to values that exceed recognized health limits by factors of ten or more. Lighting levels within occupied spaces have been reduced, sometimes by factors of two or more, and little concern has been expressed regarding degradation of the quality of light, visual acuity or visual comfort.

Studies of environmental control strategies at BEUL indicate that compromises between environmental quality and energy conservation are not always necessary. To the contrary, judicious selection of energy conservation strategies can improve environmental quality. However, as factors of safety are eliminated through energy conservation, buildings may become less forgiving environmentally. Thus, demands for more precise and reliable control systems have increased during the last decade.

Concern regarding the cost effectiveness of environmental control strategies has also increased as the costs of energy resources have escalated during the last decade. Costs of energy are now sufficient to cause some confusion between the concepts of energy conservation and fiscal conservation. Thus, many projects (e.g., some active solar energy systems), have been undertaken in Iowa, as well as elsewhere, which may have reduced the depletion rates of non-renewable energy resources, but which did not prove to be cost effective. Conversely, some projects (e.g., conversions from electric resistance heating to wood or coal burning stoves) have reduced fuel bills for space heating, but have not reduced consumption of natural resources. Yet other measures (e.g., insulation of single family residences) have proven to be both energy conserving and cost effective.

Methods by which control strategies can be evaluated for energy conservation and for cost effectiveness have been pioneered by BEUL at Iowa State University. Some of these methods are now incorporated in the State Administrative Code which requires life-cycle costing (e.g., rate-of-return analysis) for decision-making for new buildings. As deregulation of fuel prices continues, the importance of these methods is expected to increase. Thus, research at BEUL should continue toward the objective of developing and reporting new information which can be used to provide cost effective, energy efficient, and environmentally safe control within occupied spaces.

3.0 RESEARCH PLAN

3.1 Rationale

Prior to the dramatic rise in fuel prices during the 1970s, standard HVAC design was based on low first-costs, ease of maintenance, and optimal thermal comfort. Little consideration was given to energy consumption, and indoor air qualtiy was maintained by liberal dilution with outdoor air through mechanical and natural ventilation. These were acceptable design practices during the days of low-cost energy, however, current and expected future economic conditions require that efforts be directed toward better building energy management.

For certain systems, energy consumption can be reduced while improving environmental quality. One example is to conserve energy by tightening the building envelope, which may also improve thermal comfort by eliminating drafts caused by infiltration. Another example is the maintenance of cooling towers. Recent evidence indicates that proper maintenance not only improves

efficiency, but may also help control the occurrence of legionellosis (Legionnaires' disease). A third example is the use of economizer control for ventilation systems to provide inexpensive cooling with clean outdoor air during moderate seasons.

Some conservation practices can lead to reduced energy consumption while having little or no effect on indoor environmental quality. Ventilation shutdown and thermostat setback during unoccupied periods are common current practices which reduce energy consumption without affecting occupants. Other possibilities include maintaining acceptable contaminant levels such as carbon dioxide by continuously controlling the ventilation rate in response to changes in occupancy load through the use of automatic feedback control systems.

Conversely, extreme energy conservation measures will ultimately lead to reduced environmental quality. In residences, tighter envelopes can result in higher contaminant levels if no provisions are made to remove or dilute the contaminants. Reduced thermostat settings can reduce energy consumption, but can eventually lead to uncomfortable conditions.

Thus, it can be assumed that decreasing the energy consumption of an environmental control system may initially increase the quality of the indoor environment, but continued decreases in energy consumption will eventually degrade the environmental quality. Life-cycle costs may also initially decrease, then increase. These effects are shown schematically in Fig. 2. Many systems in use today can be characterized toward the right of this figure, due to their low first-cost (I). Figure 1 indicates that alternatives may be possible which can reduce energy consumption and life-cycle costs, while improving indoor environmental quality to a maximum (A). However, further reductions in life-cycle costs or energy consumption may

be at the expense of maximum environmental quality. Some alternatives may be identified which will result in a minimum life-cycle cost (B), beyond which further reductions in energy consumption may lead to further decreases in environmental quality and to increases in life-cycle costs. The degradation of environmental quality associated with (B) is relative to (I), and may not result until condition (C) is obtained. At this condition, the maximum energy savings may be achieved without degrading the existing enviromental quality, but the life-cycle costs may not be minimized. Ultimately, a minimum acceptable level of indoor environmental quality (D) will limit the amount of energy reduction achievable in a given system. Furthermore, at this condition, the life-cycle cost may be significantly increased above the minimum that is achievable.

When buildings should be controlled to achieve maximum environmental quality (A), minimum life-cycle cost (B), minimum energy consumption without compromise to the indoor environmental quality (C), or minimum energy consumption subject to minimum acceptable environmental quality (D) is the primary issue to which BEUL is directing its research efforts.

3.2 Specific Scope of Research

To help focus on the primary issue of adequately controlling environmental quality within buildings, cost effectively and energy efficiently, factors that affect control strategies are considered at BEUL to be contained in the four zones shown in Fig. 3:

- The micro-environment contains those factors to which the occupant is intimately exposed. It includes boundaries such as clothing and respirable air.

- The mini-environment contains those factors which may be controlled to meet the requirements of the occupants. It includes boundaries such as walls, celings and floors, but excludes the boundaries of the micro-environment.

- The meso-environment contains those external factors which perturb control of the mini-environment. The meso-environment includes boundaries such as property sites or local effects of landscaping, but excludes the boundaries of the mini-environment.

- The macro-environment contains those factors not included in the other zones, and it has a strong climatic influence on control of the mini-environment.

The specific scope of research which is pursued at BEUL is concentrated within the mini-environment, but may extend into the other zones as needs and interests arise. The factors of concern within the environmental zones are energy, environment, and economics.

3.3 Priority of Research Efforts

To address the development of cost effective, energy efficient, and environmentally safe control strategies, research is needed in the following areas:

1. Development of rational methods for simulating the energy and power requirements within occupied spaces, and for simulating the corresponding energy consumption and power demands at the building boundary that result from the use of various control strategies.

2. Evaluation of the impact of various control strategies on the quality of indoor environments.

3. Analysis of economic implications of implementing various control strategies.

3.3.1 Simulation. Methods of predicting energy consumption for new building design are being investigated by several laboratories around the world. However, most of these investigations are limited to theoretical analyses and are not verified by comparison to energy and power data recorded in actual buildings. Moreover, these methods are not site-specific and are not developed for use in analyzing the performance of existing buildings.

The most common weakness in existing methods of estimating consumption is the omission of the interactive effects which occur in the actual systems. For example, insulating the walls and ceilings of buildings can reduce the energy requirements (i.e., thermal loads) within the occupied spaces, but if the furnace was originally oversized and was not modified to match the new loads, its reduced part-load efficiency under the new conditions will be aggravated. Thus, an actual reduction in energy consumption to meet the new energy requirement may not occur at all due to the interactive effects. Conversely, if the furnace capacity was modified to more closely match the energy requirements, a greater reduction in energy consumption may result that would be estimated by analysis of the thermal loads without consideration of their interactions with the system.

A site-specific model, which is being developed at BEUL, accounts for interactive effects as shown in Fig. 4. Energy balances are derived for each module in the schematic, but in a manner that provides a rational representation of the actual system under consideration. When each module has been modeled, the results are then compared to actual fuel bills and the model is "calibrated" to more closely simulate the actual building performance.

This modeling technique was originally developed at BEUL for manual solutions. However, it was time consuming. So, we are adapting it for

solution on a minicomputer. The philosophy we are using in the adaptation is that a solution can be obtained through an interactive process with the conputer, but no default solutions will be provided. Thus, professional knowledge of the operation of the system being modeled will be required of the analyst.

We anticipate completion of the adaptation to the minicomputer in 1982, but refinements to the model will require additional development. First, we are adding procedures that will allow performance analysis of active and passive solar energy systems which may be added to existing systems. Second, we are now expanding the program so it can be used to estimate energy requirements and consumption rates in new building design. Third, we plan to add to the programs the capability of estimating power requirements and demands. The purpose of the third phase is to evaluate methods which can shift the time during which energy will be consumed at the building site. The results of these load shifts are expected to reduce the costs of energy supplied to the building sites by reducing the depletion rates of the energy resources at the generating plants.

3.3.2 Environmental evaluation. The methods of simulation we are developing are based on values of indoor temperatures, relative humidities, and lighting levels which are specified by the analyst. These values, which may have been obtained through energy audits, or by design calculations, are considered as independent variables in the simulations. Ventilation rates may also be obtained through energy audits or by design calculations, but indoor air quality has not yet been incorporated into our simulations. Futhermore, other indoor environmental factors, such as acoustics, fire

safety, security, and the quality of lighting are not yet addressed in our simulations. Thus, the second priority of research at BEUL is to develop appropriate methods to evaluate environmental quality in buildings.

We are developing these methods through field studies and laboratory experiments. Through field studies, objective evaluations are being made of such factors as dry-bulb, dew-point, and mean-radiant temperatures; concentrations of viable and non-viable particulates, and gases and vapors; levels and frequency distribution of lighting and sound. Subjective evaluations are also being obtained by surveys and interviews with the building owners, operators, and occupants. Such factors as thermal comfort; "acceptable levels" of odorous contaminants, lighting and sound; and the quality of lighting and sound are being evaluated through these subjective field studies.

Field measurement of the objective and subjective factors is the primary objective of this research. Some methods of objective field measurement now exist, such as the use of dry-bulb temperature and relative humidity recorders, foot-candle and sound pressure meters. But, field instruments to measure particulate and gaseous concentrations in non-industrial environments are not readily available. Moreover, because of non-uniform mixing of air within occupied spaces, little is known, quantitatively, about the concentrations of these factors to which occupants are actually exposed. We are attempting to identify instruments that may be appropriate for these measurements. Furthermore, when required, we will attempt to develop new sensors, instruments, and control strategies.

Even less is known about the subjective responses that can be expected from the occupants who may be exposed to various combinations of the

contaminants. Field instruments for measurement of these subjective responses are being developed and validated for the appropriate measurements.

Results of these objective and subjective field measurements may be used to evaluate the performance of existing environmental control systems through services such as those offered by Iowa Class A Energy Auditors. These results may also be used to aid in the design and specifications of energy efficient environmental control systems for new buildings. In both cases, the use of the results in the development of simulations will be important. We plan to extend the simulation programs to include estimation or prediction of the "quality of the indoor environment" that might result from a proposed control strategy. Thus, the values of the environmental factors would no longer have to be assumed by the analyst as they may be predicted by these simulations.

3.3.3 Economic implications. As the costs of owning and operating buildings have increased so much during the last few years, the need has also increased to control indoor environments within ranges that are economical to operate, and that are not deleterious to the occupants. Our third priority, therefore, is to develop analytical methods which are sensitive to energy and environmental factors, as well as to the more conventional factors used in engineering economics.

Some methods, which are based on the concept of life-cycle costing, have been developed at BEUL and are being used in several programs in Iowa. These methods, which have also received serious national and international attention, can be used to evaluate and rank energy conservation opportunities in existing buildings (Models I and II), and to evaluate and rank alternative designs for new buildings (Model III).

Two major limitations of these models are their inability to account for demand or time-of-day charges, and their insensitivity to risks or benefits that may result from choices indicated by them. Therefore, we plan to add to the present models the capability of including consideration of various rate structures for electrical and fuel consumption. We anticipate that this addition will not only include modification of the economic models, but may necessitate some changes to the energy consumption models. The changes to the energy models will probably include more sophisticated dynamic modeling of the periods when peak loads are expected.

We also plan to extend the economic models to include risk/benefit analysis of proposed modifications or design alternatives in terms of health, comfort and safety of the occupants, and in terms of welfare of the property and furnishings contained within these buildings. Qualitative and quantitative risk/benefit analysis is a relatively new field which has not been standardized. We plan to study this field thoroughly, and to integrate the appropriate methods into our predictive models.

Within the residential sector, the use of life-cycle cost methods has been limited, apparently due to the complexity of the calculations. Some of this criticism is probably valid as most homeowners would probably use manual calculations. However, with the general availability of programmable calculators and minicomputers, life-cycle cost and risk/benefit methods of analysis should provide homeowner, designer and policy maker with more reliable answers than those from simple payback methods now in use. Moreover, the methods of risk/benefit and life-cycle cost, which we plan to develop, may lend themselves to simplification without introducing the biases now present in the most common methods used within the residential sector.

Results of these economic studies, together with the energy and environmental studies, are expected to be used primarily by designers and policy-makers. Designers should be able to use these methods to evalute proposed design alternatives. Policy-makers should be able to use these methods to evaluate the effectiveness of proposed rules, codes, standards, or legislation which would pertain to new or existing buildings. These analytical methods will provide predicted results in terms of:

- Energy requirements in occupied spaces.
- Environmental quality in occupied spaces.
- Energy consumption at the building boundary.
- Power demand at the building boundary.
- Depletion rate of natural resources at the power plant.
- Life-cycle costs of proposed alternatives.
- Risks and benefits to occupants.
- Risks and benefits to owners.
- Risks and benefits to society.

4.0 RESOURCES AVAILABLE TO BEUL

Research conducted by BEUL pertains to new and existing buildings. So it is as necessary to obtain data from actual buildings, if credibility in the results of mathematical and physical models of proposed buildings is required. Fortunately, we have available to us instrumented residential and non-residential buildings from which we can obtain performance data. We also have several laboratory facilities available to us, in addition to our own facility.

4.1 Laboratory Facilties

The primary laboratory facilities for BEUL are housed in the old Synchrotron Building which is located 1-1/2 miles west of the main ISU campus. This facility contains the BEUL offices and 1500 ft^2 of laboratory. In addition, the roof of the building serves as a platform for solar collectors that we are investigating.

Within the laboratory space, we have access to several main-frame computers via telephone lines and three in-house minicomputers.

A solar test stand has been designed and built within this facility for evaluation of liquid-type collectors. In its present phase, this test stand is capable of testing only one collector at a time. It consists of a closed loop circuit filled with a water/glycol mixture. Within the circuit, an electric heater and a heat exchanger are capable of controlling the inlet temperature into the collector. Measurement equipment includes temperature sensors, pressure transducers, an electronic turbine flow meter, and a weather station comprising dry-bulb temperature, wind speed and direction, and total and direct radiation. The data are gathered by a minicomputer-driven data acquisition system.

Although this test stand does not comply with current standards which regulate collector testing, some simple additions can easily convert it for compliance. A design has been completed for this purpose and expansion to simultaneous multiple collector testing can also be accomplished when deemed necessary.

Two environmental chambers are now being constructed at BEUL, one in which similitude studies can be conducted on air mixing characteristics in occupied spaces, the other to study system characteristics related to various

control strategies which may be employed for thermal and air quality control in occupied spaces.

4.2 Field Facilities

To evaluate energy consumption in existing facilities, we have collected data in approximately 6,000 residential and non-residential buildings throughout Iowa for the Iowa Energy Policy Council. However, these data only consist of monthly fuel consumption and building occupancy. Portable energy auditor instrumentation gives the capability of obtaining more detailed analysis in State-owned buildings. For intensive field studies we also have access to buildings which have been specifically instrumented for this purpose.

4.2.1 ISU Energy Research House. This facility is the site of most of the intensive research we have conducted in a residential building. The details of this facility are described in the brochure, attached as Appendix A. Published studies which we have conducted have been reported at state, national and international meetings. A list of publications relating to the Energy Research House is attached as Appendix B.

4.2.2 Carver Hall, ISU Campus. This 150,000 ft^2 office and classroom building has been instrumented so that the energy consumption of the units serving the second and third floors can be determined. The environmental quality in the occupied spaces of these floors can also be monitored. Thus, this building serves as a facility in which objective and subjective responses to various control strategies can be obtained. The capability of conducting analysis of variance exists in this facility due to the manner in

which the systems have been instrumented. It should be noted that since this building is occupied most of the time, any studies which involve modification of existing control strategies must be approved by the ISU Committee on Use of Human Subjects in Research. Studies which have been conducted in Carver Hall are listed in Appendix C.

4.2.3 Other non-residential facilities. Intensive system and subsystem investigations have been conducted in Mary Greeley Memorial Hospital, National Animal Disease Center, and the ISU Power and Physical Plants, all located in Ames, Iowa. Also, in a joint venture with Honeywell, we have conducted intensive energy and environmental quality studies in the Fridley Junior High School, Fridley, Minnesota. Studies which have been conducted in these facilities are listed in Appendix D.

4.4 Inter-Laboratory Relationships

The number of laboratories specializing in building science research is not large. Without close, direct communications with those laboratories, the results of research in this field could easily lack coordination. We have attempted to locate those laboratories working in this field, to establish communication with them, and in some cases, to establish exchange programs. To date, we have established academic exchange programs with:

Departamento de Mecanica
Faculdade de Engenharia
4099 Porto Codex
PORTUGAL

Universite de Liege
Laboratoire de Physique du Batiment
15, Avenue des Tilleuls - Bat. D1
4000 Liege
BELGIUM

93-385 O - 82 - 11

In addition, we are in the process of working future exchange programs with:

National Bureau of Standards
Center for Building Technology
Gaithersburg, MD

National Research Council
Division of Building Research
Montreal Road
Ottawa, Ontario K1A 0R6
CANADA

Technical University of Denmark
Laboratory of Heating and Air Conditioning
Building 402
DK 2800 Lyngby
DENMARK

We also have established close working relationships with:

Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720

Kansas State University
Manhattan, KS 66506

John B. Pierce Foundation
Yale University
290 Congress Avenue
New Haven, CT 06519

5.0 FUNDING

Research projects at BEUL are funded primarily by contracts from industry, from state and from federal agencies. Other sources of funding include grants, allocations from ISU, and consultation fees. The administration of all funds, both internal and external, is through the Engineering Research Institute.

5.1 Internal Funding

The BEUL has been identified as a separate line-item budget within the Engineering Research Institute of the College of Engineering for the first time this year. This budget provides one-fourth of the salary for the BEUL Director and for the salary of the BEUL secretary. In addition, a small allocation for supplies has been budgeted.

5.2 External Funding

Most of the funding for BEUL operations must be obtained from external sources. Several methods of external funding are being pursued by BEUL.

5.2.1 Grants. As a result of a grant award, research projects will be conducted on subjects of mutual interest to the granting source and to BEUL.

5.2.2 Contract research. In response to receiving a contract, BEUL will conduct specific research projects as agreed upon.

5.2.3 Consultation. BEUL will consult with professional organizations and government agencies on a fee basis. BEUL will not provide consultation directly to building owners or occupants, as this is considered to be a conflict of interest with its educational role in training of professional consultants.

5.2.4 Center for Advancement of Building Technologies. Efforts are underway to establish a program that would be supported by industrial and consulting firms, and by government agencies. Each participant will provide an agreed upon annual sponsorship. In return, the sponsored funds will be used for research of particular interest to the contributors. We anticipate the commencement of the Research Center in summer, 1982. A prospectus of this Research Center is attached as Appendix E.

6.0 CONCLUSIONS

- Buildings in Iowa consume about 50% of the State's annual supply
- Recent data indicate that conservation efforts have been more successful in the commercial sector that in either the residential or industrial sectors
- Trends in energy consumption are toward more electrical use and less direct consumption in buildings
- Energy consumption in existing buildings will predominate for the foreseeable future
- Maintenance of acceptable environmental quality is compatible with good energy management, but greater care is required to assure reliability of control systems
- Minimal life-cycle costs are compatible with good energy management

7.0 RECOMMENDATIONS

- A high priority be given to the development and publication of methods to accurately predict energy consumption in new and existing buildings. These methods should be field-validated against actual fuel bills before they are promulgated.

- Analytical and experimental methods of assessing the indoor air quality of residential and commercial buildings should be developed.

- Applications of sound economic models should be developed to evaluate various energy conservation opportunities.

- Academic programs should be sponsored to train personnel to validate the energy, environmental and economic "performances" of buildings.

Table 1.
1980 Energy Consumption Patterns in Iowa [1/]

Sector	Direct Consumption			Electric Consumption [2/]			Total Consumption		
	10^{12} Btu	Δ% from 1975	% of Direct	10^{12} Btu	Δ% from 1975	% of Electric	10^{12} Btu	Δ% from 1975	% of Total
Residential	131	-14	20	109	+16	38	240	0	26
Commercial	81	-9	13	67	-19	24	148	-13	16
Industrial	208	-4	32	109	+14	38	317	-1	34
Transportation	225	-16	35	--	--	--	225	-16	24
TOTAL	645	-11	100	285 [3/]	+4	100	930 [4/]	-7	100

[1/] Based on 1976 and 1980 EPC Annual Reports.

[2/] Assumes combined conversion efficiency and transmission efficiency of 27%.

[3/] Compares with 323 x 10^{12} estimate (p. 65, EPC, 1980).

[4/] Value compares to 725 x 10^{12} Btu retail consumption (p. 65, EPC, 1980), and 1033 x 10^{12} Btu deliveries (p. 63, EPC, 1980).

Table 2.
1980 Energy Resource Utilization Patterns in Iowa[1/]

Resources	Residential			Commercial			Total		
	10^{12} Btu	Δ% from 1975	% of Residential	10^{12} Btu	Δ% from 1975	% of Commercial	10^{12} Btu	Δ% from 1975	% of Total
Natural Gas	83	-10	35	61	-20	41	302	-17	32
Petroleum	44	-24	18	14	+17	10	337	-13	36
Coal	84	+53	35	56	+14	38	195	+33	21
Nuclear	20	-13	8	12	-43	8	66	0	7
Hydrp	9	-25	4	5	-54	3	30	-15	3
TOTAL	240	0	100	148	-13	100	930[2/]	-7	100

[1/] Based on 1976 and 1980 EPC Annual Reports.

[2/] Total consumption value compared to 725 x 10^{12} Btu retail consumption (p. 65, EPC, 1980), and 1033 x 10^{12} Btu deliveries (p. 63, EPC, 1980).

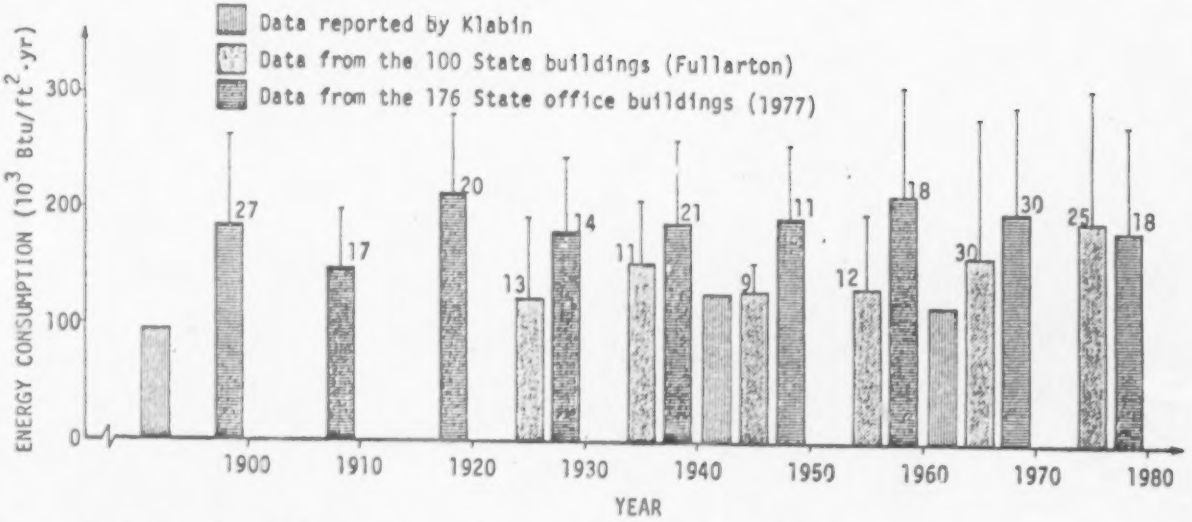

Figure 1. Average Annual Energy Consumption for Office Buildings in New York, the 100 State Buildings and the 176 State Office Buildings Surveyed in Iowa (Mean, SD).

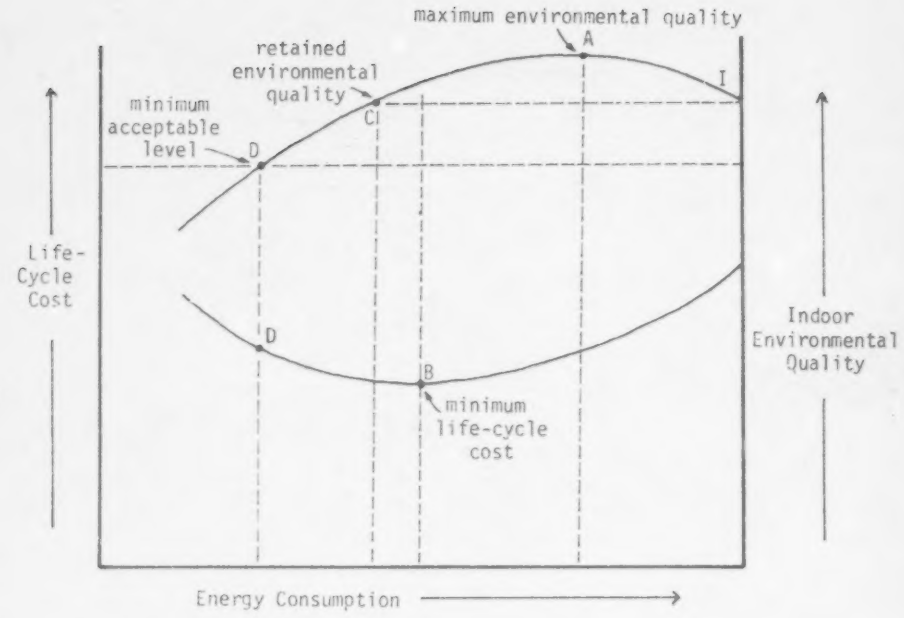

Figure 2. Possible effect of energy consumption on life-cycle cost and indoor environmental quality.

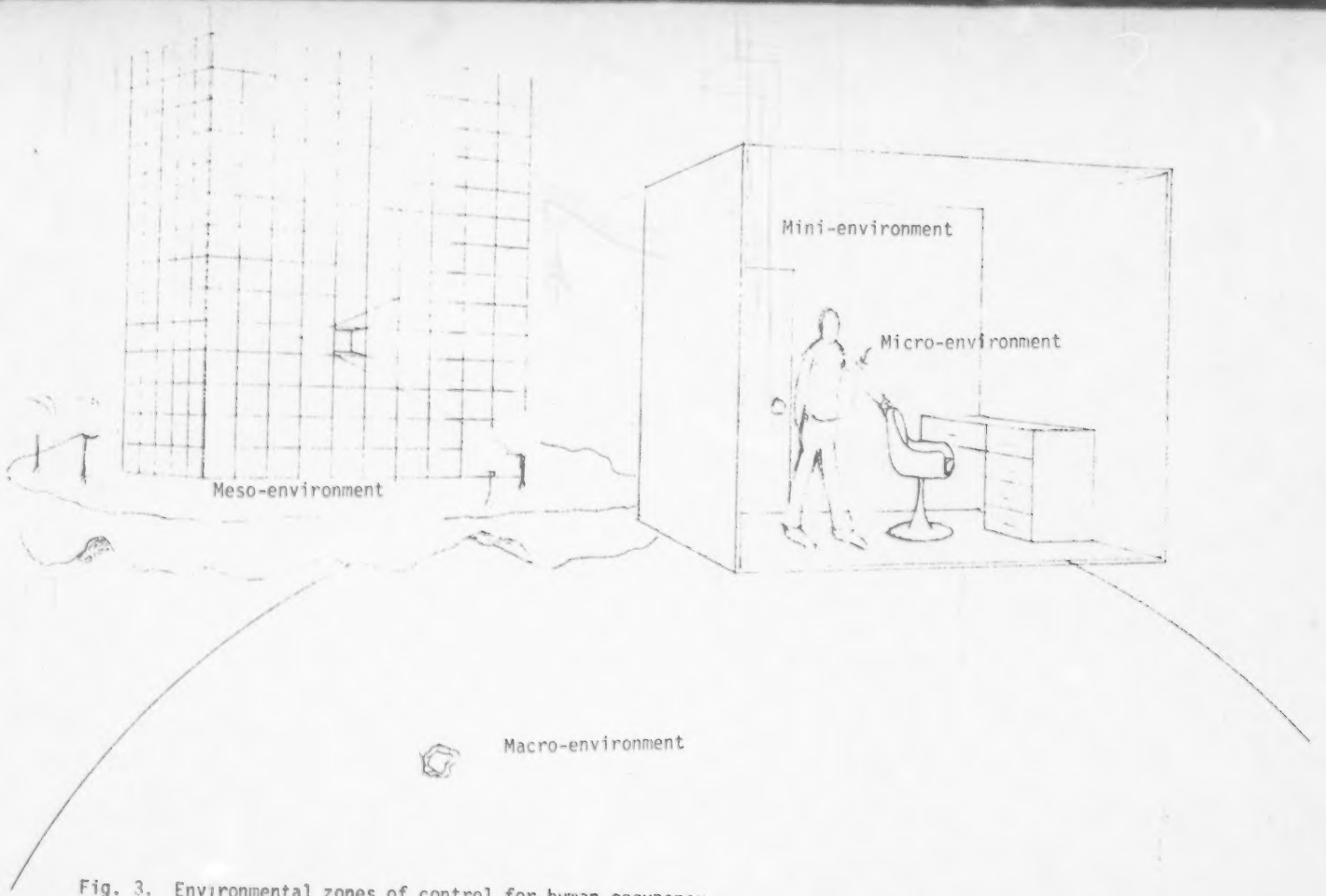

Fig. 3. Environmental zones of control for human occupancy.

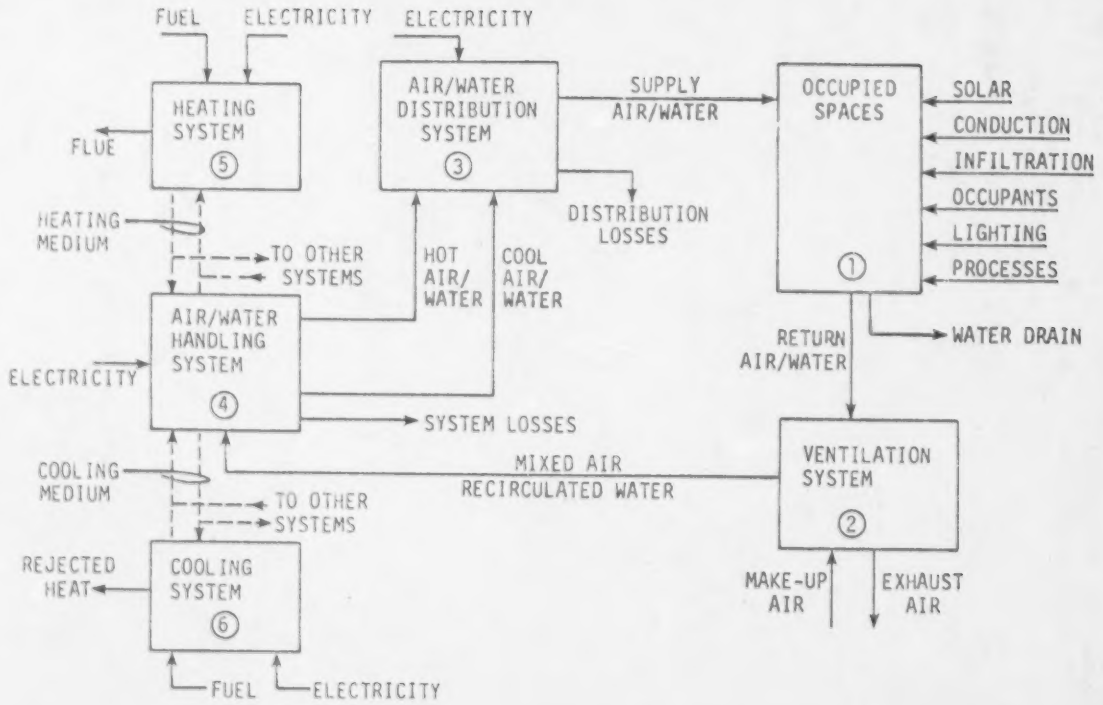

Fig. 4. Schematic representation of building subsystems that are used in developing a daily energy profile.

Mr. HARKIN. As you pointed out, DOE has sponsored a fairly extensive research program on energy use in buildings and they have done it over the last 5 or 6 years. Has it been a good program? I am asking you to make a value judgment.

Dr. WOODS. Overall, I think given the mandates that DOE had when it was instituted in 1976 or 1977, bringing the two previous agencies together, taking care of that problem and coming up to speed in a crisis situation, it has been outstanding. We are seeing the effect in Iowa. We are seeing a net reduction in energy consumption in the last 5 years.

Mr. HARKIN. As a direct result of this?

Dr. WOODS. My feeling is that the reductions were accomplished to a great extent, through the DOE programs.

Mr. HARKIN. Because they have got the data to look at? Is that what you are saying? From that you get data on which to make rational decisions?

Dr. WOODS. Right. I think that is one aspect. Obviously, the increase in cost is another factor, but if we look at the shift in electricity for gas, what we are basically seeing is that there is not that much difference, for instance, in the residential sector. The gas consumption has been offset by electricity. But that reduction in gas consumption to a certain extent has to do with weatherization, I think.

In the commercial sector, the reduction in electricity has to do with the energy audits, probably to a greater extent in hospitals and schools in the institutional grants program. I think it has had an impact.

Some of the research that's been done in the conservation solar group has been very good. My feeling is that we are going to lose one of our strengths in this field if DOE programs are eliminated. We are losing some very good talent and some momentum in energy research in buildings because of the decision not to continue an agency and not to continue DOE, especially in solar and conservation.

Mr. HARKIN. Will the marketplace pick it up, with increased fuel costs? Won't private industry step in to do that kind of stuff?

Dr. WOODS. I have a hard time believing that because we are looking at very large programs. To get the data that we really need to make quantitative decisions, we have to have a national data base. We are looking at a proposal right now that has been requested by the Electric Power Research Institute on energy efficiency, infiltration and indoor air quality. It is less than a $1 million project. We are talking in terms of multimillion dollar requirements to get the data that we need. I see no way that industry is going to be able to take it up or have the wherewithal to coordinate a national effort.

Mr. HARKIN. This program is going to be terminated next year.

Dr. WOODS. Right.

Mr. HARKIN. And, obviously, from your comments, you do not think that is a wise step.

Dr. WOODS. I really don't. I think one mistake that DOE made was do assume that energy audits are simple and that anybody can do them. To do it right, it is very complicated. We do not train engineers in that technique at all at the undergraduate level. I think

we are going to have to develop a whole new curriculum and an expertise for people to be able to go in and look at buildings from an energy standpoint and an environmental assessment standpoint if we are going to have the responsibility of dealing with the welfare of the people in those buildings. And, I think, it is going to be a very complicated, extensive program, that is going to be required.

Mr. HARKIN. You have raised another question. Has anything happened in the curriculum at Iowa State, for example, or at any other engineering schools?

Dr. WOODS. It is beginning.

Mr. HARKIN. It is beginning.

Dr. WOODS. Right, but we are talking about a generation gap. Through our continuing education program and the energy extension services, we are trying to contact the professionals in the State now. But much inertia is there. Mr. Ames was talking about that a while ago. It is just built in. People are working at a certain level in the profession and they just really don't have that much time or motivation to change their way of operating.

So, I think that we need a lot of incentive and I think that leadership has got to come on a national basis.

Mr. HARKIN. You heard my question earlier about the role of the State or local government in passing ordinances, laws, zoning, or building codes, that type of thing.

Dr. WOODS. Right.

Mr. HARKIN. As a way of pushing us to conserve. Do we have enough data on which they can make those kinds of decisions?

Dr. WOODS. No.

Mr. HARKIN. So, we need better the data before they can make those kinds of decisions.

Dr. WOODS. This is the very problem in the building energy performance standards program that was developed for DOE by the AIA Research Corporation. I think we spent—well, depending on whose numbers you look at—$20 to $30 million to come up with the draft of the building energy performance standards. The problem is that not a single building was monitored before those recommendations were made. At BEUL, we looked at 1,600 buildings in the State and compared our numbers from the real buildings to those that were proposed by BEPS, and we found out that those that we classified energy efficient, already complied. And those that were what we called energy excessive were two or three times more energy consuming than BEPS. But nobody has bothered to look at real data and compare them against BEPS on a national basis.

And so, no, we do not have that data.

Mr. HARKIN. Do we have enough of a data base to make minor changes?

Dr. WOODS. Yes.

Mr. HARKIN. It seems to me——

Dr. WOODS. Let's say, on a component performance, we do. We can do that.

Mr. HARKIN. OK.

Dr. WOODS. But I don't think we can set a mile-per-gallon for a value for a house right now.

Mr. HARKIN. OK. If we are looking at States taking on this burden, States and municipalities, they need data. They can't get the data because it requires, as you say, a big data base, That can only be done on a national scale. So, if we cut out the funding for that, we really pull the rug out from under the municipalities and the States, because they need the data to do the job that we are trying to get them to do. It boggles my mind. You just can't make decisions in a vacuum. You have got to see how those decisions impact in other areas. If you say we are just going to turn it over to States and local communities, you have got to say how can they do it without us also doing the research and getting the data?

Dr. WOODS. Now, Wisconsin has a program, I think, that is a model in their building inspection division. Every set of plans is reviewed by an architect or engineer in the State office.

Mr. HARKIN. Is that a State law?

Dr. WOODS. That is a State law, and they have a semiperformance standard for their buildings. The way they do this is that the State charges on a per-square-foot basis of the building for the assessment of those plans.

Mr. HARKIN. Is this just for commercial buildings?

Dr. WOODS. I believe it is for commercial buildings. I am not sure whether a homebuilder has to submit his plans or not.

Mr. HARKIN. Well, does the state have the miles-per gallon thing?

Dr. WOODS. Yes; they do.

Mr. HARKIN. How did they get that data?

Dr. WOODS. They have done it on design day base rather than on an annual basis. So, instead of Btu's per square foot per year, they have a requirement in Btu's per hour and that tells you more about the size of the equipment that you have in the building. That is the equipment is rated on a design basis, and on a rate or power basis instead of an energy basis. So, you talk in terms of power instead of energy.

Mr. HARKIN. Very good.

Dr. WOODS. Just adding one statement, looking at projections for the next 20 years, one study that we have done indicates that if we continue the growth rate of construction in the State right now, that is at the level of about 1½ percent a year in new floor area, both residential and nonresidential buildings. The—I misspoke. The population and, the floor area are increasing by a rate of a half a percent a year. Construction growth is increasing at about 1½ percent a year.

If we intend to keep that ratio of new square footage per unit of growth in the construction industry, we will have to see about a 2½ percent impact per year on existing buildings, which means adaptive reuse and retrofit.

Mr. HARKIN. You lost me, Jim.

You are projecting a floor-space increase of a half a percent per-year.

Dr. WOODS. Right.

Mr. HARKIN. But a total unit building——

Dr. WOODS. No, of growth in economic terms, for the construction industry of 1½ percent a year.

Mr. HARKIN. All right, I am with you so far.

Dr. WOODS. If we want to see that growth for the construction industry and we only have a half a percent per year in new space, that means that we are going to have to have adaptive reuse for use and rehabilitation and retrofit.

Mr. HARKIN. Oh, I see what you are saying.

Dr. WOODS. It means a new market. We are going to have to generate a market for that construction industry. And this also looks toward energy efficiency.

Mr. HARKIN. Our last witness today, Mr. Eugene Sukup, president of Sukup Manufacturing Co., Sheffield, Iowa.

Thank you very much and please proceed, Mr. Sukup.

STATEMENT OF EUGENE SUKUP, PRESIDENT, SUKUP MANUFACTURING CO., SHEFFIELD, IOWA

Mr. SUKUP. We run a manufacturing plant of 125 employees at Sheffield, Iowa, which is approximately 100 miles north of here. We started it about 17 years ago, after we had been in the farming business approximately 15 years and had been picking corn and drying corn.

We bought our first drying system and started drying with it and, since we were born and raised during the 1930's, when all costs were high, we thought the costs were too high for this and we developed an energy saving method of drying that cut about 50 percent of our energy costs even back in the 1960's. So to cut energy costs on the farm, it is important to know where most energy is used. And if you will look in the back of your folder that I handed you there, you will see an energy chart that was developed by Michigan State University, giving a breakdown of farm energy use. This is for a typical nonirrigated, midwestern farm.

The chart does not include the indirect energy use in the production of fertilizer, herbicides. As you can see from this chart, 60 percent of all that fuel that the farmer purchases is used in grain drying. For this reason, grain drying is one of the first places to look for improving agricultual energy efficiency. It really amazed me that it was 60 percent, when you take plowing, tillage and everything, that 60 percent of these costs are used in grain drying. And this is typical throughout agricultural production, whether it is in the North or the South, throughout the United States.

Grain drying is an essential process on Midwest farms. Many crops such as corn would spoil and rot if stored immediately after harvest. Artificial drying with propane has proven to be the most economical and safe method for preserving these grains. Alternative methods such as leaving the grain in the field to dry longer are unacceptable since the field losses due to weather conditions more than offset any drying costs.

Farmers have become aware of the fragileness of our energy supply due in general to higher prices and specifically to the propane shortage during the height of the grain drying season in the early 1970's, when there was no propane to dry the grain whatsoever.

However, finding new energy sources for agriculture can be very exciting as each farm has the potential for being self-sufficient in energy. During the 1975–76 school year, my son, Charles, who was

a senior in the ag-engineering department at Iowa State University, worked on a project to burn corn stalks as a fuel for drying grain.

Mr. HARKIN. Was that with Wes Buchele?

Mr. SUKUP. Yes. His interest continued and I also became interested. After he graduated with a BS in ag-engineering, he came back to work for the company. We experimented with several different burner designs and began marketing one in the fall of 1980. Our experiments indicated that in order to use stalks, it would need to be gathered a year in advance. This would involve an additional use of energy to gather the stalks.

We then experimented with taking the cob and the husk material that is normally discharged from the back of a combine. We will call this material "husklage." The husklage has little nutrient or fertilizer value and is normally spread back in the field. We built a device to collect the husklage from a six-row combine and blew the material into a forage wagon. This wagon which is normally used to haul silage for cattle feed, was used to feed our burner system.

By drying our crops with husklage, we can replace 60 percent of the fossil fuel used on the farm with a renewable energy source. With husklage, there is very little added energy costs. The combine must still go through the field to shell the corn. Now it merely pulls the forage wagon but no extra energy is needed to process the husklage. The husklage from 25 percent moisture corn can readily be burned for drying the crop.

In fact, one cart of husklage will dry 2 acres of shelled corn testing 25 percent moisture. This means we have an additional energy reserve in the field which can be used for heating the hog house, chicken house or even the home.

Husklage has a heating value of 6,000 Btu per pound. Since there are 15 to 18 pounds of this material available from each bushel of corn, we have 90,000 Btu available per bushel of corn or the equivalent of 1 gallon propane per bushel.

In 1981, the total USDA corn crop was 8 billion bushels. This is the equivalent of 8 billion gallons of propane, plus it is renewable each and every year.

Sukup Manufacturing Co.'s BioMaster crop residue burner develops up to 3 million Btu's, comparable to other drying systems on the market. It is completely automatic after the first 15 minutes of operation, maintaining 120 to 160 degrees Fahrenheit in the drying chamber. No extra fossil fuel is needed to start or run the burner. It is a direct-fired furnace meaning the combustion material goes directly into the grain. We have had no problems with smoke or odor in the grain because of the complete combustion process.

The furnace operates at internal temperatures of up to 1,400 degrees. A filter of lava rock aids in removing any ash particles from the airstream. The forage wagon containing the husklage is pulled up to the burner where it is attached to a special drive controlled by a thermostat. The temperature of the furnace is controlled by the amount of fuel fed into the furnace. The temperatures can be maintained as close as a gas furnace.

We had 16 of these furnaces in operation this past fall and all of the customers are satisfied. If you will look in your folder, also, you will see the article that we have put in there, the Sunday Journal,

you may want to read this. This tells of one of our customers over in Illinois who used this for drying a considerable amount of grain.

We also had a couple of brothers up in northern Iowa that dried 100,000 bushels with two of these furnaces this past year.

Not only does this system have tremendous potential for the Midwest but also other parts of the Nation. We have been working with Jim Donald of Auburn University, Auburn, Ala., on drying peanuts. We have tested the completely automatic furnace system, using peanut hulls as a fuel. A large bin has been used for storing and feeding the hulls. The burner was connected to a 50-horsepower fan for drying the peanuts. The system was inspected by Jim Donald and Pete Thompson from Sessions Oil Co.

A similar system was then installed at Sessions Oil Co. at Enterprise, Ala., Auburn University sponsored a field day and will do further testing this winter.

The possibility of drying corn, peanuts, and other grains is fantastic.

In conclusion, I feel that we have a great opportunity to make the American farm energy independent. The technology is available today for replacing 60 percent of the fossil fuels used on a farm with a renewable energy source, the crop residues.

Plus, there is a tremendous potential to utilize these crop residues in heating and energy applications beyond grain drying. Any attempts, well meaning though they may be, to keep the fossil fuel prices artificially low will only hinder the goal of decreasing our dependence on foreign fossil fuels.

I would certainly like to thank the committee for inviting us to appear on your committee.

[The prepared statement of Mr. Sukup follows:]

93-385 O - 82 - 12

Mr. Sukup's Prepared Statement on Energy for Agriculture

Let me introduce myself; I am Eugene Sukup. I farmed in north central Iowa for 15 years. In 1963, I had an idea for improving my in-bin grain drying system by installing an open auger in the grain to mix grain for faster, more efficient drying. After experimenting with this on my farm, I went to a local welding shop and had the first units manufactured. This eventually grew into a manufacturing business, currently employing 125 people. We manufacture a full line of grain drying and handling equipment on which I currently hold 15 patents. I would like to visit with you regarding several concerns of mine as well as what steps can be taken towards energy efficiency.

In studying energy use on the farm, it is important to know where most energy is used. Enclosed is a chart developed by Michigan State University giving a breakdown of farm energy use. This is for a typical non-irrigated midwestern farm. (The chart does not include the indirect energy used in the production of fertilizer, herbicides, etc.) As you can see from this chart, 60% of all the fuel that a farmer purchases is used in grain drying. For this reason, grain drying is one of the first places to look for improving agricultural energy efficiency.

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Farmers have become aware of the fragileness of our energy supply due in general to higher prices and specifically to the propane shortage during the height of the grain drying season in the early 70's. However, finding new energy sources for agriculture can be very exciting as each farm has the potential of being self-sufficient in energy.

During the 1975-76 school year, my son Charles, who was a senior in Agricultural Engineering at Iowa State University, worked on a project to burn corn stalks as a fuel for drying grain. His interest continued and I also become interested. After he graduated with a B.S. in

Agricultural Engineering, he came back to work for the company. We experimented with several different burner designs and began marketing one in the fall of 1980. Our experiments indicated that in order to use stalks, they would need to be gathered a year in advance. This would involve an additional use of energy to gather the stalks. We then experimented with taking the cob and husk material that is normally discharged from the back of a combine. We will call this material husklage. The husklage has little nutrient or fertilizer value and is normally spread back on the field. We built a device to collect the husklage from a 6-row combine and blew the material into a forage wagon. This wagon, which is normally used to haul silage for cattle feed, was used to feed our burner system.

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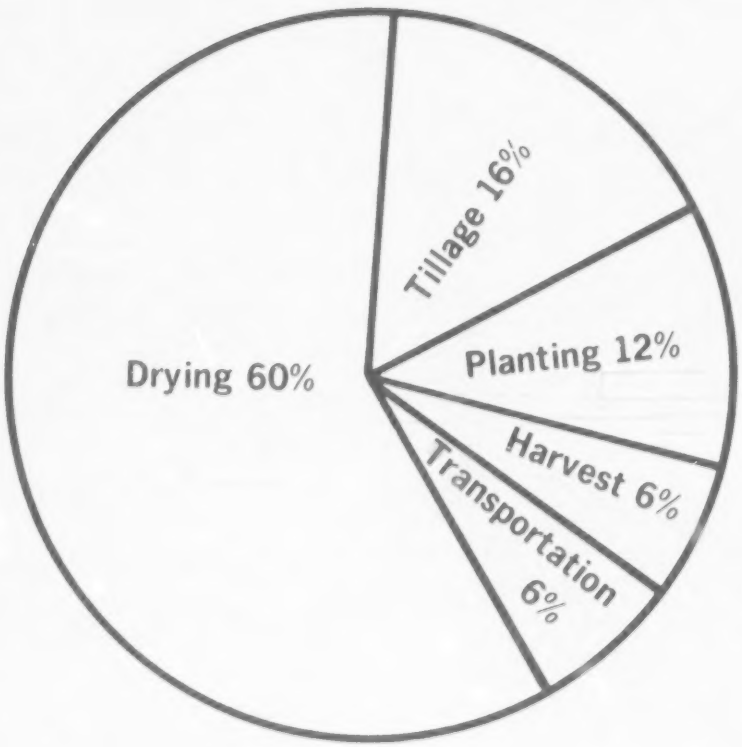
Grain Production Energy Use



Sukup Manufacturing Company Sheffield, Iowa 50475 • Phone 515-892-4222

THE SUNDAY JOURNAL

Kankakee, Illinois Sunday, November 15, 1981 8 Sections, 98 Pages 50 Cents

Biomass?

Shucks, it's just cobs

By Robert Themer
Journal writer

CRESCENT CITY — Government energy bureaucrats call it "biofuel," in a "biomass converter." To Don Koester, it's simply a sensible way to dry corn.

But Koester, of rural Crescent City, is possibly the first Illinois farmer to use corn to dry his corn.

This fall Koester installed a $14,000 on-farm drying unit that burns corn shucks and cobs, which usually are plowed under in fall or spring.

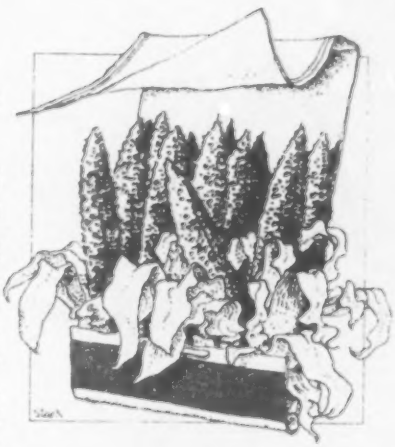
Using those by-products enables Koester to beat the increasing cost of propane, which has jumped 500 percent in the past decade.

Collectively, Illinois farmers could save from $8.2 million to $21 million if they followed Koester's lead, according to a report of the Illinois Department of Energy and Natural Resources.

Koester is old enough to remember that, not too long ago, burning cobs for heat was a common thing on the farm. Many a cold morning the coal furnace or woodstove was re-kindled quickly with a half-bushel of hot burning cobs.

Probably millions of gallons of water were heated over cob fires in old-time water heaters that had to be fired-up by hand for Saturday night baths and Monday washings.

Nobody called them "biofuel" then. They were just cobs. Either you burned them in the stove or water heater or you burned them in the pile after shelling, just to get rid of a relatively useless by-product.



Many a night was lit up with those glowing mounds. Occasionally the sparks burned down a barn or two, as well.

Today most of the cobs are returned to the soil — spewed out in broken pieces behind the combines that pick and shell the corn in one operation.

See COBS, page 6

Cobs

Continued from page 1

Koester's cob- and shuck-burner is probably the only one within a couple hundred miles, said Leroy Norder of Ford-Iroquois FS, who sold Koester the unit.

But Koester is confident many of them will dot the countryside as other farmers decide to beat the rising costs of fuel for grain drying.

"Gas prices had been bugging me. I'd been trying to figure something out for years," Koester said.

Call it biofuels, crop residue of just plain shucks, cobs and silks. "It works like a dream," he said.

"I dried 14,000 bushels of 28 percent (moisture) corn for about a penny a bushel," he said. That's the cost of electricity to run the augers that feed material into his burner, and fans that blow the heated air into the bin.

His penny-a-bushel compares to nearly 16 cents per bushel for propane fuel to reduce 28 percent moisture corn to the optimum safe storage level of 15½ percent moisture, according to figures from the University of Illinois' College of Agriculture.

Koester's penny-per-bushel doesn't include the cost of the system itself or of collecting the crop residue from the field.

He figures fuel savings and tax breaks will pay off the system in three years. There's a 10 percent energy conservation tax credit and a 10 percent investment credit to help.

The Department of Energy and Natural Resources agrees with his assessment — about three years fuel savings alone will do the trick on many farms.

Using such a system to heat farm buildings or to fire an alcohol production plant could reduce the pay-back period, the study says.

The ENR study of residue burning systems sets costs of collecting the material and operating the system much higher. It estimates total crop residue costs at $2.25 to $6 per million BTU heat, compared to $7.86 for propane.

But Koester says the unit that hurls cobs and shucks from the rear of his combine into a silage wagon pulled behind it is adding nothing to harvesting expense. The add-on collector cost about $2,500 to purchase, but Koester says there is no noticeable increase in combine fuel use.

"The combine's running through the field anyway," he adds.

Other systems require bailers or stackers to gather the material and add extra field trips to the fuel collection costs.

Regardless of whose figures you use, switching to such systems could save Illinois farmers a bundle.

Collectively, the state's farmers burn 45 million gallons of liquid propane a year in on-farm drying systems. The ENR department estimate shows savings potentials of 24 to 70 percent with crop residue burners — $8.2 million to $21 million a year.

And, that's at today's price of about 67 cents a gallon for propane (it was 13 cents in 1971, Koester recalls). "It's going to get higher ... when they deregulate it, look out!" Koester says.

The shucks and cobs alone off one acre have been enough fuel to dry about eight acres worth of this year's wet crop, Koester said. That's not enough to worry about depleting the soil of nutrients from decaying plant residue or to worry about leaving the soil bare and highly susceptible to erosion, he said.

"That much blows away," he said. "If you pick ear corn and put it in cribs it ain't any different; you're taking all the cobs off every acre then."

Koester's system leaves the stalks in place on the ground. But the state energy department reports that even with systems that collect stalks too, the farmer can afford to take 1,000-2,000 pounds per acre off corn ground, which usually produces about 4,000 pounds of crop residue.

A loaded five-ton silage wagon carries enough fuel for about 12 hours of drying, Koester said. Corn cobs, shucks and stalks have about two-thirds of the energy content of coal, the ENR department says. A ton of the material has the heat potential of 134 gallons of propane — nearly $90 worth.

Temperatures in Koester's burner can hit 1,600 degrees, at least — that's as high as the controls indicate. Koster keeps the chamber at about 1,000 degrees and mixes that heated air with outside fresh air to cool it to about 150 degrees when it enters the bin.

Automatic controls mean the unit needs little babysitting. Koester said he checks it once a day.

The system sends smoke through the bin. That caused at least one neighbor to stop and tell Koester he had a bin fire. But the smoke doesn't taint the corn, Koester says. You can't smell or taste smoke on the corn and his elevator tested it, determining there was no detectable residue, he said.

The manufacturer claims there is less residue on the corn than from propane systems, Norder said.

Alternative systems are available that employ heat-exchangers to keep smoke separate from the air that circulates in the bin.

The cost of the systems probably will scare a lot of farmers away, Koester said. But the idea of beating gas costs has attracted visitors from as far away as Greenup, Ill., about 150 miles south.

"There were a lot of people who thought I was about half a bubble off level when I put it in," Koester said. But, he adds, "I think you're going to see a lot more of them. I'm well satisfied."

"Now," he said, "if I could just figure a way to run the tractor on cobs ..."

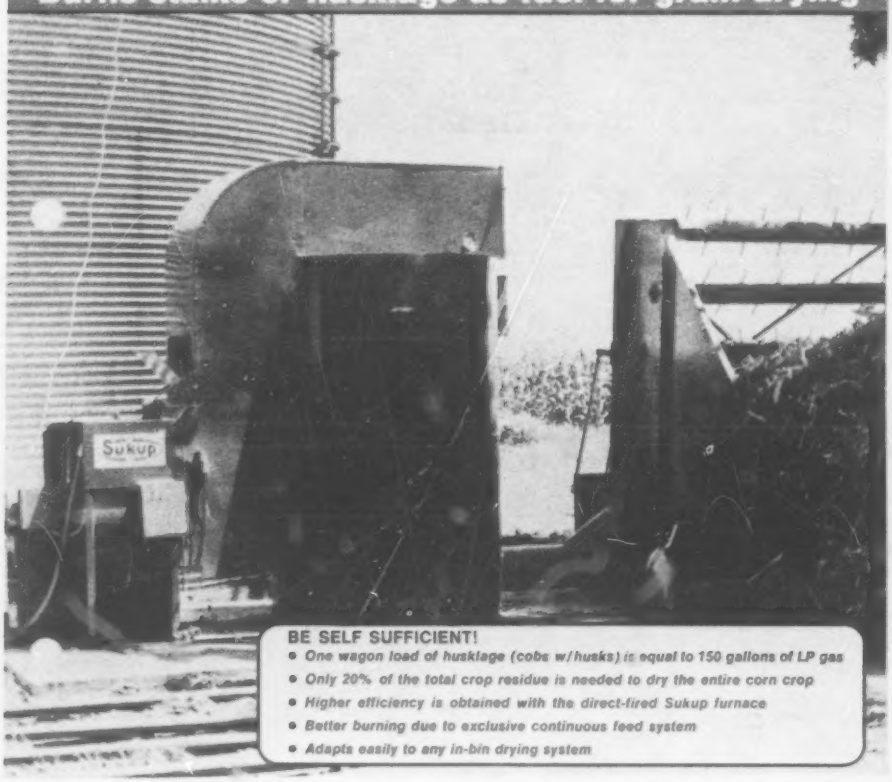
NEW

Sukup

BioMaster™

Crop Residue Drying System

Burns stalks or husklage as fuel for grain drying

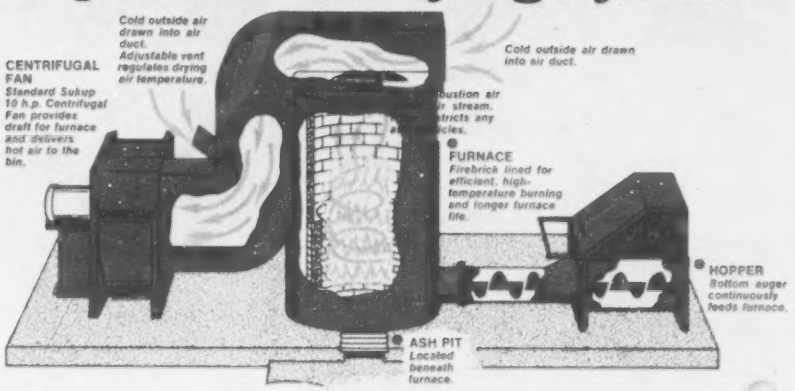


BE SELF SUFFICIENT!

- *One wagon load of husklage (cobs w/husks) is equal to 150 gallons of LP gas*
- *Only 20% of the total crop residue is needed to dry the entire corn crop*
- *Higher efficiency is obtained with the direct-fired Sukup furnace*
- *Better burning due to exclusive continuous feed system*
- *Adapts easily to any in-bin drying system*

Sukup BioMaster™

Crop Residue Drying System


Cold outside air drawn into air duct. Adjustable vent regulates drying air temperature.
CENTRIFUGAL FAN
Standard Sukup 10 h.p. Centrifugal Fan provides draft for furnace and delivers hot air to the bin.
Cold outside air drawn into air duct.
FURNACE
Firebrick lined for efficient, high-temperature burning and longer furnace life.
HOPPER
Bottom auger continuously feeds furnace.
ASH PIT
Located beneath furnace.

New Grain Drying System Burns Crop Residue

EFFICIENTLY • ECONOMICALLY • CONVENIENTLY

The Sukup BioMaster System is designed to cut grain drying costs by eliminating the need for costly propane and other fossil fuels. Dry grain by burning a fuel that's renewable year after year. Use the crop residue from the grain itself . . . Here's how:

• ***PRACTICAL.*** Just one wagon load of cobs and husks from the combine is equal to 150 gallons of LP gas. In field tests, one 16' forage wagon full of the cob and husk material supplied the burner for about 10-12 hours. Field tests show that one acre of residue will remove 10 points of moisture from 280-300 bu. of corn. Utilizing crop residues guarantees that your drying fuel will be available.

• ***THERMOSTATICALLY CONTROLLED.*** High-temperature thermostat continuously monitors furnace temperature. Controls feed the correct rate of fuel to maintain even burning.

• ***CONTINUOUS SELF-FEEDING SYSTEM.*** Bottom auger feeds fuel to furnace. Auger is motor-driven and controlled by furnace thermostat. When furnace temperature reaches thermostat setting, the feed auger shuts off. When the furnace temperature decreases, the feed auger automatically starts.

• ***HIGH EFFICIENCY*** obtained by direct fire furnace. All combustion air enters air stream. No heat exchanger to add greater cost and reduce efficiency. No supplemental propane is needed.

• ***FLEXIBLE.*** The furnace provides large volumes of high-temperature drying air (120°-180° F). Easily adapts to in-bin drying. NOTE: Drying temperature and operation of furnace should be carefully monitored by operator.

• ***CLEAN BURNING.*** Firebrick aid in retaining high temperatures needed for clean burning. Turbulent air action within furnace facilitates complete combustion. **Note** it's important that only dry crop residues (less than 35% moisture) are used. As with any piece of machinery, careful supervision of the equipment is suggested.

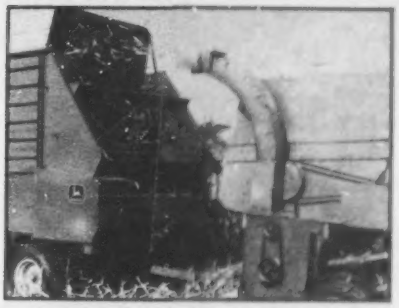
• ***SOIL CONSERVATION.*** Only 20% of the crop residues from one acre of corn will dry all the corn harvested from that acre at 10 points removal. The residue not used for drying remains on the field for organic matter and soil conservation.

Save with 20% Investment Tax Credits

Two Feeding Systems Available

1. The Forage Wagon System

Use standard forage wagon



Combine Blower Attachment

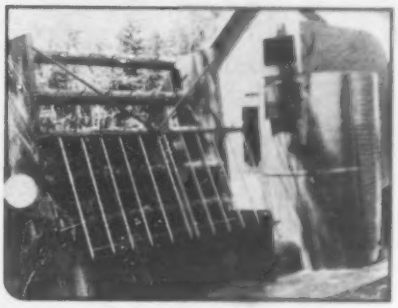
Sukup Blower kit attached to the rear of combine where it catches the husks and cobs. The unit is mechanically driven by the combine to blow the cobs and husks into a forage wagon which trails the combine. Extensive field testing has resulted in a ruggedly built unit. When not in use, a hinged panel in bottom of blower allows residue to drop to ground as usual.

Forage Wagon Drive Unit

After the wagon is filled, pull the wagon to the burner, and connect the wagon's PTO shaft to the electric gearmotor stand available from Sukup. The gearmotor, which is controlled by thermostat, drives the wagon unloader. This maintains an even flow of fuel into the furnace for uniform, efficient burning.

2. The Stack Feeder System

Uses standard stacks or bales

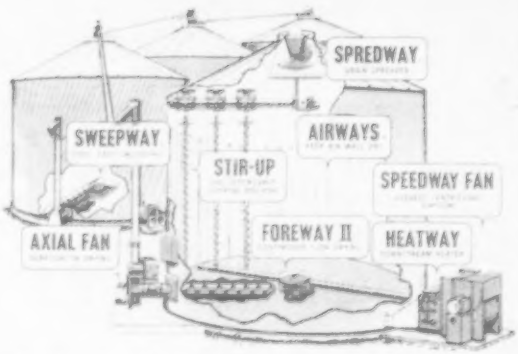


The stack feeder will hold a stack up to 8' x 16'. The stack feeder tears material from the stack or bale as it slowly feeds the furnace. The feed rate is controlled by the furnace thermostat. Continuous feeding produces a more even heat and prevents the flare-ups and uneven burning that occurs when burning an entire bale all at one time. A bale will last 3-6 hours depending on furnace temperature, type of residue and bale size. It is recommended that stacks be allowed to dry for one year before burning. (A stack feeder system is also shown on the cover of brochure)

Sukup GRAIN HANDLERS:

The basic grain drying system features Stir-up for batch-in-bin drying. Fill bin and dry. With Stir-up you don't have to worry about over – dried grain. Efficient drying at low cost.

For greater capacities add a Foreway II . . . for continuous flow drying. Low initial investment, efficient drying and flexibility make the in-bin continuous flow system one of the most popular on the market today.



- *Saves Energy & Time.* Reduces fuel consumption by drying grain twice as fast.
- *Saves Money.* Lower investment — less than any other continuous flow drying system. Lower operating cost. — Lower cost per bushel than any other continuous flow drying system.
- *Is Dependable.* Sukup's farm proven reputation for sound design, solid construction, and good workmanship adds up to dependable performance on your farm and longer service life.
- *Is Flexible.* Adapts easily to your present drying system, and other Sukup equipment as your needs grow.

Sukup . . . Why not get the best, especially when it costs less than others?

Sukup Manufacturing Co. • Sheffield, Iowa 50475 • Phone 515-892-4222

PRINTED IN U.S.A.

Sukup

BioMaster Crop Residue Burner

SUGGESTED LIST PRICE
Effective July 1, 1981

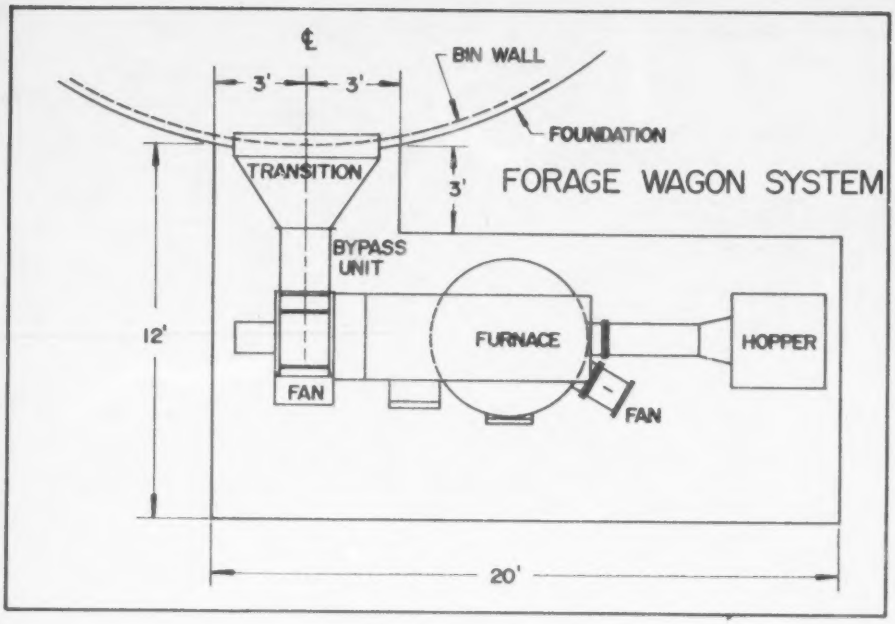
Computer #	FORAGE WAGON SYSTEM	LIST PRICE
G5000	FURNACE with firebrick, high temperature thermostat controls and bypass unit. Adapts to Sukup 10hp centrifugal fan	$ 6,900.00
G5100	FURNACE, for 20hp centrifugal fan	
G5200	COMBINE BLOWER, attached to rear of combine. Blows crop residue into residue wagon. Driven by hydraulic motor w/8 gallon capacity	2,250.00
G5250	FORAGE WAGON DRIVE. Gearmotor and mount which adapts to any forage wagon for feeding into furnace. Feed rate controlled by furnace thermostat.	790.00
G5275	FORAGE HOPPER, to be used with forage wagon	1,390.00
	TOTAL - FORAGE WAGON SYSTEM*	$11,330.00
	*Does not include centrifugal fan or forage wagon	

	STACK FEEDER SYSTEM	
G5000	FURNACE with firebrick, high temperature thermostat controls and bypass unit. Adapts to Sukup 10hp centrifugal fan.	$ 6,900.00
G5100	FURNACE, for 20hp centrifugal fan	
G5300	STACK FEEDER, will handle crop residue stacks and bales. Slowly tears material from bale for feeding into furnace. Feed rate controlled by furnace thermostat. Handles 8' x 16' stacks.	6,500.00
G5375	STACK HOPPER, to be used with stack feeder to feed crop residue into furnace.	1,650.00
	TOTAL - STACK FEEDER SYSTEM*	$15,050.00
	*Does not include centrifugal fan.	

NOTE: $200 non-refundable deposit required on special order BioMaster systems. Standard BioMaster system require no deposit.

Prices are subject to change without notice.
Prices in effect at time of shipment shall apply to all shipments.
Prices are F.O.B. Sheffield, Iowa 50475

Revised from 12/1/80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FURNACE
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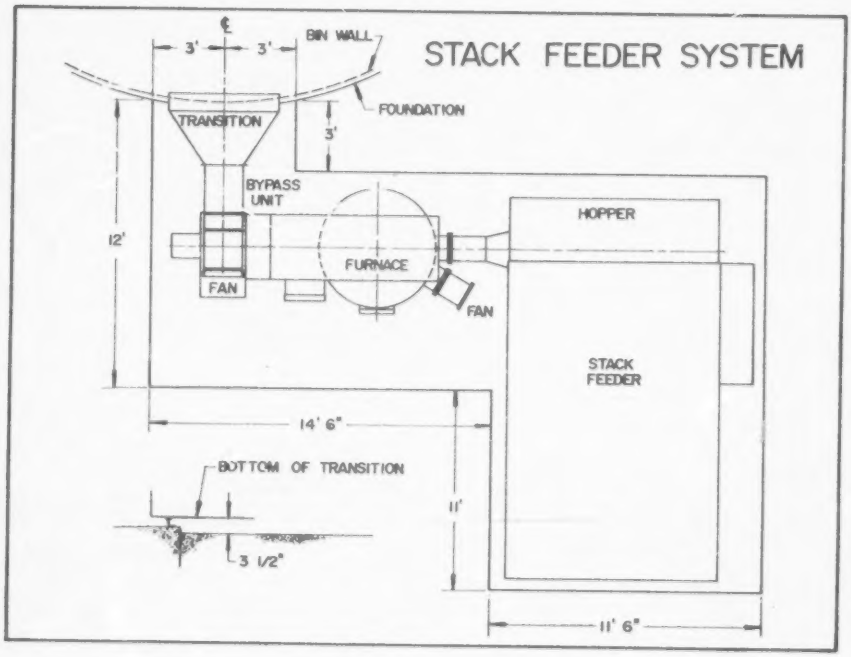
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14' 6"
BOTTOM OF TRANSITION
11'
3 1/2"
11' 6"

DCA

Architects and Engineers

PERFORMANCE DOCUMENTATION

of

CROP RESIDUE BURNER

for

SUKUP MANUFACTURING
Sheffield, Iowa 50475

July 1, 1981

Design Center Associates, P.C.
169 Main Street
Dubuque, Iowa 52001
Tel.(319)582-7241

PRODUCT OVERVIEW

The BioMaster Crop Residue Drying System would fall under the category of a waste conversion alternative energy system. It replaces the conventional fossil fuel burner applications and require no backup system because of the continuous feeding design.

The waste material being consumed consists of 72% cobs and 28% husks which can be gathered at the same time the grain is harvested. In order to remove 10 points of moisture from the grain it is necessary to harvest approximately 20% of the husklage (cobs and husks) from the field.

Our review of the BioMaster was based on an inspection of the unit in operation and the information which is contained on the following pages.

BASIS FOR COMPARISON

To determine the fuel costs, the University of Nebraska AGNET computer simulation drying programs was utilized. A 30', 9000 bushel bin was chosen to be used with a 10hp Sukup centrifugal fan. A 52% drying efficiency was calculated for a moisture removal of 10 points and a plenum temperature of 160°F. The efficiency of the L.P. heater and the BioMaster were both assumed to be 80%. The energy cost for operating the 10hp fan is considered to be the same for both systems so that cost is not included in this analysis.

The cost of L.P. was taken to be 64¢/gal. and the cost of electricity at 5¢/kwh. A biomass harvest-transport fuel cost was estimated at $10/ton with a gross energy content of 7758 btu/dry lb. The biomass moisture content was taken as 35% wet basis.

The average annual energy load will be determined by the size of the farming operation. Thus all drying costs are figured on a $/bu. basis to allow quick analysis for different sized operations.

In order to establish a basis for determining the cost effectiveness of the system we will assume the biomass burner would be used in a batch drying setup and the grain would be transferred from the 9000 bushel drying bin to storage bins. We will also establish a minimum of two

fills (18,000 bushels) in the drying bin. It would be very unlikely for someone to invest in this system with substantially less grain being produced although the system could be justified for smaller applications.

93-385 O - 82 - 13

COMPARISON OF SYSTEMS COSTS

1. Conventional L.P. Burner Setup

Investment costs:

L.P. heater (model D10L-HL, FOB Sheffield, IA)	$ 1,320.00
10hp fan (model 10-271, FOB Sheffield, IA)	1,980.00
4' x 8' concrete foundation	30.00
1000 gal. L.O. storage tank and fuel line	1,300.00
Installation (4 hours)	28.00
Total system cost	$ 4,658.00

Annual maintenance:

Clean or replace spark plug, clean fuel strainers, etc. (2 hrs./season)	14.00

2. Alternative Energy System - Waste Conversion

Investment costs for forage wagon system:

BioMaster forage wagon system (includes furnace, combine blower, forage wagon unload drive, forage hopper). Does not include fan, forage wagon. FOB Sheffield, IA	$10,880.00
10hp fan (model 10-271, FOB Sheffield, IA)	1,980.00
12' x 20' concrete foundation	138.00
Installation (10 hours)	70.00
Total system cost	$13,068.00

Annual maintenance:

Filter maintenance, ash removal (7hrs/season)	50.00

PER BUSHEL FUEL COSTS CALCULATIONS

Plant Part	% Dry Material *
grain	50.4
cobs	11.5
stalks	19.8
leaves	9.4
husks	8.8

* (For grain harvested @ 25% moisture content A.S.A.E.)

Gross energy content of cobs = 7961 btu/dry lb.

Gross energy content of stover = 7150 btu/dry lb.

Heat of vaporization water = 1060 btu/lb.

The cob moisture content is about 45% M.C.W.B. when the grain is 25% M.C.W.B. (from Hall, Dictionary of Drying - page 116), assume husks are at 10% M.C.W.B., assume that we collect all of the cobs and half of the husks with the combine blower. Our mixture will then be 72% cobs and 28% husks.

Net energy of cobs @ 45% moisture content =

(0.55 dry lbs/wet lb)(7961 btu/dry lb)-(0.45 lb H_2O/wet lb)(1060 btu/lb H_2O)=

3901 btu/wet lb.

Net energy content of husks @ 10% moisture content =

(0.90 dry lbs/wet lb)(7150 btu/dry lb)-(0.10 lbs H_2O/wet lb)(1060 btu/lb H_2O)=

6329 btu/wet lb.

Net energy content of cob-husk mixture =

(0.72)(3901 btu/wet lb)+(0.28)(6329 btu/wet lb) = 4581 btu/wet lb.

Net energy yield =

((45.6 dry lb/bu of grain)÷(0.504))x(((0.115)÷(0.55 dry lb. cob/wet lb))+

((0.044)÷(0.90 dry lbs. husk/wet lb))x(4581 btu/wet lb)=

106,925 btu/bu. of grain harvested

Equivalent LP energy yield =

(106,925 btu/bu. of grain harvested)÷(91,500 btu/gal of LP) =

1.2 gal of LP/bu. of grain harvested

From A.G.N.E.T. programs; 30' bin, 9000 bu, 10 hp fan:

2039 btu required/lb. of H_2O removed (10 pts. removal) @ 160°F.

For 10 pts. removal we must remove 7.2 lbs H_2O/bu grain

Energy required using L.P. =

((2039 btu/lb H_2O)(7.2 lbs H_2O/bu)($0.64/gal.))÷((91,500 btu/gal)(0.80 eff.)) =

$0.13/bu.

Energy required using Biomass burner =

((2039 btu/lb H_2O)(7.2 lbs H_2O/bu))÷((4581 btu/wet lb)(0.80 eff.)) =

4.0 wet lbs/bu.

% Biomass to be collected =

((2039 btu/lb. H_2O)(7.2 lbs. H_2O/bu))÷((106,925 btu/bu)(0.80 eff.)) =

17%

Waste feeder system electricity costs:

Gearmotor = 5.3 amps, 115 volts

Auger motor = 10.8 amps, 115 volts

Apron chair drive sprocket speed = .25 rpm

Apron chair drive sprocket diameter = 4 in.

Forage wagon dimensions = 8'h x 8'w x 16'l

Biomass bulk density = (1500 to 2000 lbs)÷(8'x8'x16') = 1.5 to 2.0 wet lb/ft^3

Waste feeder system electricity costs continued:

Max feed rate = (0.25 rev/min)x((4 in)÷(12) ft/rev)x((64 ft^2)(1.75 lb/ft^3)) = 29 lbs/min.

Power consumption = ((5.3+10.8 amps)(115 volts)(0.85 PF))÷1000 = 1.6KW

Feeding cost per bu = ((4.0 lbs/but)(1.6KW)($0.05/KWhr))÷((29 lbs/min)(60 min/hr.)) = $0.0002/bu.

Biomass harvest-transport cost = $10/ton =

(4.0 lbs/bu.)x($10/2000 lbs) = $0.02/bu.

ENERGY SAVINGS INFORMATION

1) $I.D.F. = (1 \div (D-I)) \times (1-((1+I) \div (1+D))^{N})$

$= (1 \div (0.15-0.07)) \times (1-((1+0.15) \div (1+0.07))^{7.5})$

$= (12.50)(1-1.72)$ (disregard negative sign as per conversation with Mr. William Dosch on 6/19/81)

$= (12.50)(0.72)$

I.D.F. = 9.0

2) Biomaster System:

(18,000 bu/yr.)x($0.0202/bu) = $363.00/yr. to remove 10 points of moisture from 18,000 bu. of grain

3) Conventional L.P. System:

(18,000 bu/yr.)x($0.13/bu) = $2,340.00/yr. to remove 10 points of moisture from 18,000 bu. of grain

4) Fuel savings per year from replacing L.P. System with BioMaster System:

$2,340.00 - $363.00 = $1,977.00/yr.

5) BioMaster System using forage wagons:

A. Total cost (minus state and federal tax benefits):

a) initial system cost (no credits deducted).....$13,068.00
b) deduction for regular investment credits (line 16, Form 3468)..... 1,307.00
c) deduction for allowed business energy investment credit (line 19, Form 3468)..... 1,307.00
d) deduction for Wisconsin rebate (16% of $10,000)..... 1,600.00

Adjusted system cost (a-(b+c+d)).....$8,854.00

B. Energy Savings Calculation:

((F.S.) x (I.D.F.)) > (A + B)

($1977) x (9) > ($8,854 + (7.5)(21))

$17,793 > $9,012

C. Simple Payback:

$9,012 ÷ $1,977 = 4.56 years

SUMMARY

As shown in the calculations, the BioMaster offers an approximate savings of 84.5% of the energy cost required to dry each bushel of grain. More importantly, it eliminates 100% of the conventional (L.P.) fuel used by the burner. Even though the initial cost of the system is more, the payback period is well within the life span of the equipment.

As was indicated earlier, the basis for comparison was an example which untilized 18,000 bushels of grain to determine energy savings and simple payback. It is important to note that on a continuous batch drying installation the BioMaster is capable of drying considerably more grain as is the conventional system. If this is taken into consideration, the energy and cost saving advantages become even more apparent with the waste conversion.

Since our office is very actively involved in all forms of heat recovery and energy conserving design, we also looked at the future potential of the BioMaster. Knowing that it takes 4 wet lbs. of husklage to remove 10 pts. of moisture from one bushel of grain and knowing that we are only removing 20% of the husklage from the field, the following information becomes very intriguing:

1) Based on 28,000 bushels x 4 wet lbs/bushel = 72,000 lbs. required
2) 72,000 lbs. is 20% of 360,000 lbs. available when harvesting
3) Thus, we have 288,000 lbs. of husklage being left in the field
4) 288,000 lbs. x 4581 btu/wet lbs. = 1,319,328,000 btu's potentially available for heating
5) If either fluid or air transfer system were utilized, this remaining heat could potentially be used in many of the other out buildings on a farm which require heat

We feel that the BioMaster is valid and cost effective investment and would ask that an approval be given for a manufacturer's approval number and eligibility for the direct rebate be granted.

Thank you for your cooperation. If you have any questions relating to this report, please contact our office.

Respectfully submitted,

DESIGN CENTER ASSOCIATES, P.C.

James D. Schroeder, Architect

Mr. HARKIN. Thank you for coming down.

That is really intriguing. But what is the bottom line? What is the cost? How long would you take to pay for it?

Mr. SUKUP. Well, you mentioned Wisconsin doing a test over there on their buildings. In order to get their energy credit, which is a 10-percent energy credit on systems such as this, we had one of these architectural and design engineers do a study—Charles, bring one of those to Mr. Harkin—and I think that drying 18,000 bushels of corn, which is approximately the corn you get off 160 acres in Iowa, would pay for itself in 4½ years.

Now, if you had a lot of grain like these gentlemen who dried 100,000 bushels, you can probably pay for this system in 2 years. And you have got to remember that this is a renewable source out there and it is equivalent to 1 gallon of LP gas for every bushel of corn that you raise out there. And the cobs and husks have very little fertilizer value in them. Most of the fertilizer that is left is in the stalk.

Mr. HARKIN. But don't you need some of that cob and husk for decaying purposes?

Mr. SUKUP. It is just the cob and the husk. See, when we are picking corn on the ear, we were taking this same matter off. We hauled it up to the yard and you saw them burn it when they got done shelling corn.

Mr. HARKIN. That is true. We used to have a cob bin in our basement.

Mr. SUKUP. Right and there is a tremendous amount of heat in these cobs. And like I say, there is very little fertilizer value and nutrients in the cob and the husk, the material that we are saving. The stalk is still out there so the fields aren't going to blow. They will still catch the snow. You can't tell that we have taken the cob and the husk off.

The problem with burning everything is that you have to have dry stalks. They have to be held over 1 year, where this material, you can take it directly from the combine, put it in your wagon, pull it right up to the bin and drop. If you have got 25 percent moisture grain out there, you can dry——

Mr. HARKIN. I thought you said you recommended picking it 1 year and keeping it a year.

Mr. SUKUP. No, this was for the stalk. We said this was the drawback for stalks.

Mr. HARKIN. Oh, I understand.

Mr. SUKUP. But this, you do not need to. You can pick your same load of corn and shell it and use those very cobs and husks to dry that corn that you have gotten out of your combine.

Mr. HARKIN. Now, as they come out of the back of the combine, you don't do any further grinding?

Mr. SUKUP. None whatsoever. We just have a blower on there that blows them into this forage wagon.

Mr. HARKIN. There is an adapter that goes on the bottom of the combine, is that it?

Mr. SUKUP. Yes, it takes the same power that comes from the combine and just blows it into the wagon. And then you take the wagon and pull it up to the furnace and we have an adapter up there, a power takeoff, that you plug onto the wagon and it auto-

matically turns it on to increase or lower the temperatures in our furnace.

One engineer that we had from Illinois that did an EPA test to see what the discharges were, if there was any problem with them, he walked around a couple of times and he said, "It is so simple, I believe it will work."

Mr. HARKIN. You said that one of these units could be used to dry the equivalent of corn for 160 acres?

Mr. SUKUP. OK, cob and husk off of 1 acre will dry 2 acres of corn. So, if you have 100-acres of corn out there, you would take just 50 acres of that to dry the corn on there and you would have the other 50 acres left to use for——

Mr. HARKIN. What I am getting at is the payback period. What size of farm would I have to be before I had to——

Mr. SUKUP. Well, Wisconsin did a study, engineers did a study over there, and they found that in 4½ years, drying 18,000 bushels of corn.

Mr. HARKIN. 18,000 bushels per year.

Mr. SUKUP. Right. In 4½ years it would pay for itself.

Mr. HARKIN. And that is the equivalent, if you are figuring—that is for how many acres?

Mr. SUKUP. Well, that is 160 acres, approximately.

Mr. HARKIN. So, if I was drying 160 acres of corn or more per year, it would pay back in 4½ years; more than that, less.

Mr. SUKUP. Right. And if you have twice, that would be approximately 2 years, because there is no added cost.

Mr. HARKIN. What is your life cycle on this?

Mr. SUKUP. Well, we figure around 7 to 8 years. We just put it down—we have to for these energy audits and the like—we built it out of stainless steel. It is fire brick, we feel it will go at least 10 years.

Mr. HARKIN. That is pretty good.

Mr. SUKUP. And it is a very simple system, trouble free. And the potential is tremendous for the cob and husk that is raised throughout the Midwest.

Mr. HARKIN. What is the biggest problem? Let me think: The drive plugs up, does it plug up?

Mr. SUKUP. Well, we have safety devices on there. I mean, we have been experimenting with this for several years so we feel that we have got that part of it. The biggest problem with it is the inconvenience of going out with the wagon to collect it and bring it in. I mean, people have to get used to it. It is just like in your testimony this morning. You mentioned that you are going to have to replace it with labor and energy, any costs, and this is the thing. It is something they have to get used to. Right now you turn a gas valve on and it is completely automatic and as long as that price of that gas is where it is at, they are not too interested in paying this extra money for something like this.

Mr. HARKIN. They may be real interested this fall.

Mr. SUKUP. We were in the business back in 1973 and 1974, when they ran out of LP gas completely. Well, they would be tickled to death to realize that right there on their farm they have all the cobs and husks and energy, millions of Btu's out there, to use this for.

It has worked excellent with peanut hulls. You are not familiar with it, but peanut hulls have to be dried also. Sunflowers. you have hulls on sunflowers, so we can burn those. Nuts, you can take the hulls off of nuts, and you can burn those in this furnace. So, there is a lot of potential here throughout the whole United States.

Mr. HARKIN. There is a plant located—in fact, I think the owner is an Iowa State graduate, too—down near St. Charles, and they built a seed corn facility. And they also built one in Wisconsin or Michigan, I forget where. And the problem was they were then interrupted because they were an interruptable source, with gas, right?

Mr. SUKUP. Yes.

Mr. HARKIN. And seed corn, you pick seed corn, you don't combine it. You pick it and you have the full cob there. They developed a system to burn the whole cob, and they were working on that. Are you familiar with that operation at all?

Mr. SUKUP. We have looked at some. I think Pioneer burned some of their cobs for years, also.

Mr. HARKIN. But you think that this won't have anything to do with the depletion of soil nutrients whatsoever?

Mr. SUKUP. No.

Mr. HARKIN. You are leaving the stalk out there.

Mr. SUKUP. Right. You can't tell in the field when we have gone through and picked the cob and the husk and taken this off to where we haven't. You can't tell it by looking at the field because the stalk is still crumpled down as you go through there.

Mr. HARKIN. That is pretty interesting. Would you have developed your grain drying system without DOE help?

Mr. SUKUP. Yes, we did.

Mr. HARKIN. OK.

Mr. SUKUP. Let's qualify that. We didn't have any DOE actually on our own.

Mr. HARKIN. You had no DOE involvement in your thing.

Mr. SUKUP. None whatsoever, no.

Mr. HARKIN. But how about some of the information?

Mr. SUKUP. When Charles was going to Iowa State University as an ag-engineer, he worked with them, Wes Bukely and the college.

Mr. HARKIN. OK, so no direct government involvement. How about in terms of research data and stuff like that which was gained through—that was DOE program, wasn't it?

Mr. SUKUP. Yes, he was funded by a DOE project.

Mr. HARKIN. Did you find any of that information that was gained from that program helpful to you in developing this?

Mr. SUKUP. Some of the information that came in, we built experimental models.

Mr. HARKIN. I just wondered if there was any impact. Slightly minimal?

Mr. SUKUP. I would say slightly minimal.

Mr. HARKIN. OK.

Let me ask you this: OK, you are an inventor, 15 patents, you have developed this device that is a pioneer in the field, what barriers are there in industry to developing more energy-efficient products? What do you see as the biggest barrier?

Mr. SUKUP. What do you mean?

Mr. HARKIN. Is it just capital, getting the money to do it, is it information, data, what do you think?

Mr. SUKUP. Well, it is mainly a demand for your product. I mean, I think there is a lot of people doing a lot of things in energy today and that we will see growth from this. But, it takes experience, it takes time. We have been 4 years on this, and we have changed it quite a bit from the start. And if it hadn't been for Charles and Wes Bukely getting me interested in burning the stalks and the things you could and could not do with it, we probably wouldn't have developed it.

But, I think you are going to see a lot of things coming down the line because you still have people out here that like to develop things and they are going to develop them. And if we can get a demand for them, this is all that is necessary to sell them. We have to have people that want to buy this product.

Mr. HARKIN. I would like to know what the potential is for the use of this type of device on farms throughout the Midwest and for peanut farms in the South, in terms of total energy savings to this country. What are we looking at? Is it a fly speck, is it big?

Mr. SUKUP. Well, you know, it is pretty much this chart.

Mr. HARKIN. Well, 60 percent of what is used on the farm. I am trying to think of the total picture of what we are using and what kind of impact that would have on energy consumption as a part of the total picture in the United States.

Mr. SUKUP. I think in the past we've seen—you know, there is a tremendous amount of energy used on farms and the like, and if we can save 60 percent of this energy.

Mr. HARKIN. Let's see what kind of figures—if it is a major—and I know it is a major part of each farm. I know that. But I want to look at the total picture and see if this really is going to have some big impact.

What would you think, Jim? You are aware of agriculture. Would you think it would have a big impact?

Dr. WOODS. It would in certain States. I think in this State it would. I was just trying to remember the data, the industrial and transportation data that showed up there included the agricultural sector. And it is a significant part of transportation.

So, you have that anyway. Now, if you can cut down the gas consumption in the industrial sector, I think in this case, you might see an impact. It is hard to really project a national, but Iowa has quite a potential there.

Mr. HARKIN. One percent? The total energy use from corn alone? How did you figure that out?

Dr. FRANKEL. Well, taking his 1 gallon of propane, which you save per bushel, and a total U.S. corn crop of 8 billion bushels that is 8 billion gallons of propane. Multiply by 90,000 Btu per bushel of corn, and that is 720 trillion Btu's, and that is about 1 percent of the energy used in this country.

Mr. HARKIN. If we reduced that by a half, we——

Dr. FRANKEL. That is a direct displacement.

Mr. HARKIN. Is that a percent of total?

Dr. FRANKEL. Percent of total.

Mr. HARKIN. What barriers are there to farmers purchasing your device? Is it just inertia, that they just haven't done it?

Mr. SUKUP. Right. They are waiting to see whether it is trouble free, and if it works and if it will do the job for them.

Mr. HARKIN. Your 4½-year payback on that 160 acres, what does that assume in terms of interest rates?

Mr. SUKUP. I don't know exactly what they did use for interest rates, but I would say somewhere around 12, as high as 12 percent, somewhere in that neighborhood.

Mr. HARKIN. Anything else?

I will open it up for any questions that anybody might have.

UNIDENTIFIED MALE VOICE. I just want to thank you.

Mr. HARKIN. Thank you again.

This brings to a close our hearing. This completes the hearing of the Subcommittee on Energy Development Applications of the House Committee on Science and Technology. I appreciate all the witnesses for taking the time and effort to come through this weather, to come here today.

I feel personally that we have some really exciting testimony which we will have available for the entire committee and which we will condense and get out to other members of the committee for them to look at and to read.

Dr. Frankel says we will have copies in my Ames office, too. We will get copies of this testimony and anybody that might want copies for whatever reasons, we will make them available to you.

I guess, if I could make a summation, I would say that what we see this morning is that ingenuity is still around the American public. People are aware of the problems and they are making an effort to address those problems. It is being done all over. It is being done individually, it is being done at the municipal level, it is being done at the State level, by private industry, and at the Federal Government level. And I think it is needed at all levels.

As I just said toward the end, the decisions that are made on a Federal level to reduce certain programs may have very bad effects on the local or individual level.

We do, indeed, have a matrix, and by taking one piece out of it, we may affect areas that at first seem far removed. The problem of energy efficiency is one that I think really demands our attention and the input from the best minds in this country.

I really believe that it is the kind of a challenge that—I don't want to sound too chauvenistic about this—was meant for Americans. Americans can do this kind of thing. There is one thing that marks the history of our country, and that is coming up with ingenious ways to meet and solve problems. And I believe this whole problem of doing more with less and doing it better is something that we can solve. It is just the kind of thing that we are good at in this country.

All we have to do is make sure that the framework is there. That is how I would sum it up, we have got to make sure that the framework is there.

So, again, thank you all for coming. Dr. Frankel says I have to use the gavel since he brought it all the way out here.

[Whereupon, at 1:25 p.m., the subcommittee was adjourned.]

APPENDIX

Additional Statement for the Record

Prepared Statement of D. F. Darby, Corporate Energy Coordinator, Deere & Co.

ENERGY MANAGEMENT HELPS US MEET

THE CHALLENGES OF TOMORROW

I wish to thank the Subcommittee on Energy Development and Applications for allowing Deere & Company to address this hearing.

The use of energy for manufacturing has been of significant importance throughout the history of John Deere.

The Company realized very early the serious implications and associated problems arising from the sourcing crisis that faces us today. In 1973, several months before the Arab Oil Embargo, we formalized our Energy Management Program to meet the challenges....today and tomorrow.

How much energy has been saved through our conservation program during the last nine years?

57 trillion BTU's. Put in other terms, this amount would be sufficient to heat approximately 420,000 homes in the Midwest United States for one year.

Since 1972 John Deere has reduced the amount of energy needed to produce a finished ton of product by 37%.

This reduction has resulted in 10% less total energy consumed despite the fact that annual finished tons of product have increased 44% during the same period and manufacturing floor space has increased by 60%.

This morning I would like to briefly explain seven key elements that have contributed the most to the success of our Energy Management Program, and then review some of the Energy Conservation Projects that have been implemented as a result of the program.

These key elements are also identifiable in other successful Energy Conservation Programs.

TOP MANAGEMENT SUPPORT is required to obtain the manpower to start and maintain the program. The manpower is needed to chart a course of action. The money to implement conservation measures will be provided when management sees the potential economic benefit.

ENERGY AUDITS are required to determine the areas with the highest potential for savings. They are planned efforts aimed at identifying, categorizing and quantifying all the various energy forms and uses that exist in a factory.

We conducted such an audit at the outset of our program. We were able to determine the magnitude of our energy use, the energy mix and conversion losses.

We also determined that on a yearly basis, environmental needs comprised one-third of our usage, and process two-thirds.

A FULL TIME ENERGY COORDINATOR at each plant has proven to be important to the Deere & Company program. If the coordinator function is a part time responsibility, other duties will dominate, and leave little time for conservation work. Since the company's manufacturing facilities are relatively large, ranging in size from 800,000 to 5 million square feet, a full time coordinator is essential.

LOCAL RESPONSIBILITY AND CONTROL is important because of the large number of plants. Plant personnel are best qualified to develop their individual conservation programs to meet their needs, and are responsible for the development and success of the local program. This localized approach generates enthusiasm among the plant personnel.

Corporate Headquarters annunciates policy, and makes all government contacts.

A REALISTIC AND OBJECTIVE YARDSTICK must be developed to measure progress. This can be a problem since no yardstick is perfect. Total energy consumed per ton of product manufactured is the measure used by John Deere.

The essential requirement for measuring results is that the data be accountable and be generated outside the group responsible for the conservation program.

AN ENERGY ETHIC becomes increasingly important as time passes. All changes must be reviewed from a total energy viewpoint. This review requires input from various disciplines working in an integrated environment so that all costs, including production, energy and utility costs are assessed.

FEEDBACK provides the communication between Corporate and Factory Management, between factories and among engineers. The company provides feedback through a quarterly energy conservation report, and an annual meeting of all Energy Coordinators.

The company is convinced that careful control of these seven key elements has produced the success that our program has achieved.

There are many energy-saving systems that have been utilized to improve existing factory buildings, and designed into new factory buildings.

SOLAR ENERGY reduces conventional energy requirements for environmental purposes at our new Industrial Training Center.

The south wall is completely covered by 10,000 square feet of glass, and comprises two separate solar systems: one to heat air, and the other to heat water.

The solar water system is used to augment the efficiency of a series of water to air heat pumps that are used to both heat and cool classroom areas.

The solar air system is used to supply a portion of the annual heating requirement of a shop area. Solar energy impinges on the 35 foot high hollow core concrete wall which is painted black, heating the wall and the enclosed air space. Air is drawn out of the shop area, and circulated through, or in front of the wall where it is warmed and returned to the shop area.

The remainder of the heating requirement for the shop area comes from a "deep heat" electrical resistance heating mat that is buried under the floor of the shop.

This system is charged at night when electric demand is lowest, to release its energy during the daytime.

SOLID AND LIQUID WASTE INCINERATION not only solves serious landfill problems and reduces the need for offsite disposal of refuse material, but also provides energy for process and environmental heating. We have four incineration systems in operation throughout the company. The largest facilities are in Waterloo and Dubuque. Smaller systems operate at Ottumwa and Horicon, Wisconsin.

LIGHTING ENERGY requirements are reduced through the use of high efficiency lamps, lower general lighting levels, and increased use of task lighting. Use of task lighting in offices places the light source close to the work being performed.

BUILDING TEMPERATURES have been reduced to conserve environmental energy. We attempt to maintain 65°F in all buildings during the heating season, and lower the temperature to 50°F during weekends and off shift periods.

Offices are air conditioned to 78°F during the summer.

CLEANING AND RECIRCULATION OF AIR offers a great opportunity to save energy. A substantial amount of the energy used in the environmental area is due to exhaust requirements.

The recirculation of factory air eliminates a large portion of the exhaust and permits heat released from process operations to be used for heating.

HEAT RECOVERY from manufacturing processes provides another opportunity for energy conservation. Even when air contains contaminants that cannot be filtered, its heat can be recovered through heat exchangers to condition the environment, or can be reused by the process.

On forge furnaces with sealed combustion chambers, for example, incoming combustion air is preheated with the waste heat that was previously exhausted.

WHAT ABOUT THE FUTURE? John Deere will continue to expand its efforts to reduce energy consumption. The urgency and importance of conservation should continue to grow.

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A prime goal for the future is the elimination of our dependency on natural gas for environmental heating, and a reduction in the use of natural gas for process heating where feasible.

We intend to maximize the use of insulation for all new installations, and add it to existing installations where it promises to be effective for energy conservation.

Finally, John Deere will continue to consider new energy sources for environmental heating to the extent that they are practical and economical. The use of sources such as solid waste, electricity, solar energy and coal must be considered, and efficient methods for their utilization devised.

In conclusion Ladies and Gentlemen, our message is to encourage the adoption of vibrant energy management programs and to work together to achieve wise use of energy.

Statement Of

AMANA REFRIGERATION, INC.

To The

SUBCOMMITTEE ON ENERGY

DEVELOPMENT AND APPLICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

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Des Moines, Iowa

January 22, 1982

Good morning, my name is John A. Kammerer and I am Vice President of Engineering for Amana Refrigeration, Inc., Amana, Iowa.

We are honored to have the opportunity to express our views before this Subcommittee on Energy Development and Applications. Our remarks are specifically directed to the theme of this hearing, "Energy Efficiency in the Midwest: What is Needed, What is Being Done." Prior to outlining our comments, I would like to briefly identify our company and the products we manufacture.

Amana Refrigeration, Inc., was founded in 1934 and is a manufacturer of quality appliances for the home. We have two manufacturing locations. In our Amana, Iowa plant we manufacture refrigerator-freezers, chest and upright freezers and microwave ovens. In our Fayetteville, Tennessee plants we manufacture room air conditioners, central air conditioners, central heating equipment and electric ranges.

Amana distributes their products nation-wide through independent wholesale distributors and company owned distributors. We also export our products to 120 different countries.

As a part of Amana's basic belief in building a quality product, we have emphasized good design, construction and quality control in order to offer better performance and reliability. For many years we have promoted the benefits of better design, including lower electrical or gas consumption, even though the initial purchase

price was somewhat higher. Fore example, in 1974 Amana introduced an energy saving refrigerator that would have exceeded the Department of Energy's proposed 1981 standards and was more energy efficient than any other similar sized unit then on the market. In other words, we are quite familiar with the principle of promoting more efficient appliances, even when the cost of energy was relatively low.

Energy savings and Amana are synonymous. Over the last several years our commitment to developing more energy efficient products has exceeded $20 million dollars. A few examples of the energy saving leadership type products that Amana has brought to the marketplace include:

- "2 Plus 2½" top mount refrigerators and upright freezers. These appliances featured increased product insulation to reduce operating costs. Conventionally designed refrigerators and freezers have approximately 1 3/4 inches of polyurethane foam insulation, whereas these models feature 2 inches of insulation around the 40°F refrigerator compartment and 2½ inches around the 0°F freezer compartment where it's needed the most to keep the cold in and the heat out.

  These particular refrigerators and freezers consumed approximately 30-50 percent less energy than comparable competitive units that were then available. These models set a standard of performance that in most cases the rest of the industry is still attempting to meet today and these energy efficient Amana models have been commercially available for five years.

- In conjunction with the U.S. Department of Energy and the Arthur D. Little Company, Amana embarked on a research and development program to design the next generation of energy efficient refrigerators. This work culminated in the production build of scores of energy efficient refrigerators that we currently still have on field test in numerous homes in the Norfolk Virginia area.

This energy efficient refrigerator (18 cubic foot in size) exhibited only a $39 per year operating cost, whereas similar sized competitive units exhibit a $45-$88 per year operating cost per the Federal Trade Commission. Thus, this particular unit has a 13 to 55 percent lower operating cost than all current competitive commercially available refrigerators.

Based on this research work and our stated company commitment to providing the most energy efficient products possible, we introduced in late 1981 the Amana "Twin System" refrigerator. This "Twin System" refrigerator features an increased insulation schedule, twin evaporators (one in the freezer and one in the refrigerator compartment) and a dramatic increase in the time interval required between automatic defrost cycles.

With this "twin" evaporator concept we are able to achieve a "moist-cold" refrigerator compartment;

thus minimizing the amount of food dehydration that normally occurs in a fan driven frost free type refrigerator system. One of the most common consumer complaints regarding frost free refrigerators is that after several days of storage the food is dehydrated and must be thrown away. This dehydration phenomenon is greatly improved in our "Twin System" model.

A key energy saving feature of this "Twin System" refrigerator is the length of time between the automatic defrost cycles. Conventionally designed frost free refrigerators defrost approximately twice per day, whereas our new unit defrosts only once every four days.

Thus, this "refrigerator-of-the-future" provides consumers with savings in two ways: 1) energy savings and 2) food preservation savings. Retail dealer and consumer acceptance of this exciting new refrigerator concept has been most encouraging to date.

- A third example of innovative Amana energy saving products is our HTM Plus(tm) Heat 'N Hot Water System. This is the most efficient combination heating and hot water system available today. For example, the Amana HTM system can save 15 to 23 percent in yearly operating costs compared to an equivalent capacity Amana upflow standing pilot furnace. That's because

the HTM Plus System incorporates the exclusive Amana Heat Transfer Module (HTM), a major breakthrough in gas heating technology. It replaces the bulky conventional heat exchanger found in most furnaces with a highly efficient combustion chamber samll enough to hold in your hands.

This HTM Plus System also provides a virtually unlimited supply of hot water. This system has a heating input of 120,000 BTUH, whereas conventional 40 gallon water heaters have about 40,000 to 50,000 BTUH heating input. The water also stays hot longer as our system loses only about 1°F per hour compared to 5-10°F per hour loss for competitive gas water heaters.

We have attached for your reference specification sheets for all three of these energy efficient products listed above.

The future in energy saving products is just as exciting as the development of these products have been. For example, our Research and Development people are actively working on a new gas furnace heating system which will have an A.F.U.E.* of 92-95 percent versus typical current gas furnaces which have A.F.U.E.'s ranging from about 50 to 85 percent as measured per U.S. Department of Energy test procedures. Additionally, high efficiency central air conditioner and room air conditioner

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*A.F.U.E. - Annual Fuel Utilization Efficiency — a standard measure of operating efficiency

products are also under development. Amana stands ready to provide the energy conscious consuming public with the energy efficient products they demand.

Regarding the consumer acceptability of higher efficiency, higher priced products, we must tell you that our results are less than that which we had hoped for. Any consumer survey taken shows that consumers are quite interested in energy efficient products, but when it comes time to buy that product they all too often opt for the lower efficiency, lower cost product. Initial acquisition cost becomes a more important consumer purchase consideration than does the "life cycle" cost of the product.

The Federal Trade Commission's Product Energy Labeling program helps in calling consumers attention to "compare energy costs before you buy", but it is not enough. Retail sales people all too often take the path of least resistance and sell "low price" rather than taking the time to sell energy savings, "life cycle cost", and payback period. We strongly urge increased federal assistance in helping to educate the consumer regarding energy efficiency and the energy crisis facing this nation.

The American public, as a whole, does not believe that an energy crisis exists. About the only time they believe it is when there are long gas lines at the local filling station. If we are ever to achieve "energy independence" the American public must be educated as to the energy crisis that is facing us.

Amana Refrigeration, Inc. has been very vocal in the past in its support of the Department of Energy's proposed minimum energy efficiency standards program for appliances. This company stance has not been very popular with other industry members, but this has not detered us in our belief.

Our latest intelligence information informs us the Secretary of Energy is about to issue his determination that minimum energy efficiency standards are not justified for any of the appliance categories that previously were targets for such standards. This "no standard" decision is to be contained in a forthcoming Notice of Proposed Rulemaking.

Conceptually, Amana agrees with this "no standard" decision for these product categories that we manufacture product for: Refrigerator/freezers, freezers, room air conditioners and kitchen ranges and ovens (including microwave ovens). For these particular product categories the free enterprise system is functioning as it was intended.

New more energy efficient products have been developed and are available to energy conscious consumers. For example, detailed below are the factory shipment weighted energy efficiency improvements that the appliance industry has realized comparing 1981 shipped product versus 1972 shipped product:

Product Category	% Efficiency Improvement* 1981 versus 1972 Product
Refrigerator/Freezers	58.1%
Freezers	52.4%
Room Air Conditioners	17.7%

The percentage efficiency improvement for room air conditioners is deceiving in that other market forces are at work which have kept this percentage improvement at a minimum, for example:

1. Substantially less total industry room air conditioners were shipped in 1981 versus 1972.

2. Consuming public is purchasing smaller capacity products in 1981 versus 1972. We have found in many cases owners of central air conditioning systems are purchasing room air conditioners for more effective "spot" cooling rather than running the high energy consuming central system.

If these market factors are taken into consideration, the 1981 factory shipped room air conditioning product consumed 47 percent less energy than did those shipped in 1972.

Amana, therefore, supports the D.O.E. proposed finding of "no standard" for these appliance categories. This "no standard" standard will also provide a Federal pre-emption of existing and

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*Source: Association of Home Appliance Manufacturers' Statistics

future state standards which are becoming so disruptive to manufacturing and distribution. Currently, the following states have minimum product energy efficiency standards of varying efficiency levels:

- California
- Kansas
- Minnesota
- New York
- Wisconsin

The States of Florida, Georgia and Texas have also indicated varying degrees of interest in establishment of minimum energy efficiency standards, with the State of Florida being the most active.

Amana, on the other hand, does not agree with the Department of Energy's proposed "no standard" for central air conditioning and furnace heating products as we believe major efficiency improvements will be achieved only through standards. The distribution method for these type products is different than for refrigerators, for example, which are sold thru retail dealers. Furnaces and central air conditioners are primarily sold to builders, contractors, apartment operators, etc.; not to the ultimate consumer. These buyers are primarily interested in lowest acquisition cost rather than "life cycle" costs.

To demonstate the relatively slow growth of higher efficiency central air conditioners being marketed, consider the following "Comparative Study of Energy Efficiency Ratios of Split System Central Air Conditioners" which is based on the Air Conditioning and Refrigeration Institute (ARI) figures:

Calendar Year	Split System Average Energy Efficiency Ratios (EER)
1975	7.16
1976	7.22
1977	7.24
1978	7.48
1979	7.51
1980	7.57

This shows that between 1975 and 1980 only a 5.7 percent improvement in shipment weighted energy efficiency has been realized.

Amana's own market experience supports this contention. In 1979 we bought out a line of high efficiency (8.3 to 8.8 SEER) central air conditioners with the intention of dropping our low efficiency (5.9 to 6 plus SEER) model line. Some time after introduction, it became readily apparent that having only a high efficiency line would put us in a very uncompetitive market position and undoubtly cost us market share. Therefore, we had to not only abandon plans to drop our low efficiency line, but that we must also develop and introduce a medium efficiency (7.6 to 7.8 SEER) line. The market for central air conditioners is not willing to accept very high efficiency products due to its increased acquisition costs. Thus, we strongly recommend that minimum energy efficiency standards be established for central air conditioning and furnace products.

Amana stands ready to do our part in obtaining our national goal of energy independence. We will provide the energy efficient products, do the necessary advertising and education of retail salespeople, but we need Federal assistance. Consumer education as to our national energy problems and the need to buy energy efficient products are the areas that we as a manufacturer can not accomplish alone.

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